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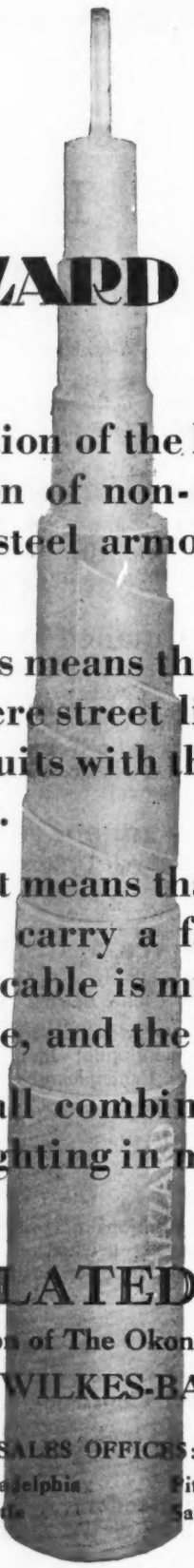
HAZARD



THIS HAZARD CABLE...

by the elimination of the lead sheath and the substitution of non-metallic armor for the usual steel armor, is rendered non-inductive.

Electrically this means that it is possible to use 20-ampere street lighting circuits instead of circuits with the present limit of 6.6 amperes.

Economically it means that the same size conductor will carry a far greater current while the cable is much lighter and easier to handle, and the cost is low.

These factors all combine to lower the cost of street lighting in material degree.

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Values in Mergers and Financing

MERGERS on a large scale and the incorporation of new companies of enormous resources are the order of the day in the utility industry as well as in other industries. What do these developments mean to the industry and to utility customers?

Utility mergers are not new. For years the industry has followed the constructive policy of making mergers and issuing securities in order to make economic savings that it shared with its customers. The record of service costs, improved service standards and economies in operation, finance and investment attests the efficiency and sound service values back of this policy. It is an important part of the plan of industry executives to take advantage of all possible opportunities to improve service, extend service and reduce the costs of service.

But some elements in the new developments should be studied seriously as to their ultimate effect on the industry and upon its customers. The older holding corporations have been based on majority stock control of subsidiary properties, but some of the new ones are pools of minority stock holdings. Other corporations are more or less investment trusts for the purpose of making money in the stock market, and still others are mergers of holding companies already in existence.

It is logical to suppose that each incorporation includes a financial gain to the incorporators and that the mergers could not be made except by giving financial inducements to stockholders of subsidiary properties or companies. Many of these mergers are accompanied by bond-to-stock transfer schemes and the customary devices to get security owners to transfer their holdings for securities of the new corporation. As a result of these movements the market prices of many operating property securities are twenty to thirty times earnings and many holding company securities are priced without reference to earnings. Instead of dividend returns, these security prices are based on market demand and increment increases created by market demands.

These conditions cannot affect utility customers directly. State regulation has been effective to fix the price of service on the basis of the fair value of the property actually used in public service. This policy is supported strongly by industry leaders and is a true safeguard to utility customers. Consequently the new developments affect the industry itself primarily. They may or may not jeopardize its future credit, and, in addition, public relations might be affected by disappointed security holders. Another element to be considered is the possible introduction of banker management in addition to banker control. This would result in serious injury, because bankers are not the type of men to manage public service properties.

No one can say that the present movement is good or bad for the industry as a whole, but inherent in it are opportunities for departing from the sound merger and financial policies heretofore followed by the industry. And if a detrimental reaction occurs, it will affect the industry itself and not the bankers who control the money pools. This has been past the experience of the railroad industry, of the sugar industry and of other branches of industry. Control of the situation rests upon utility executives—it is their responsibility and they only are competent to decide in this matter.

* * * *

Load-Factor Business Essential

INVESTMENT and revenue trends in the utility industry point to the necessity for high-load-factor business. This may be had from amplified domestic service and from the development of electrochemical and electrothermic processes in industry. In the latter field, during the past thirty years, the business has grown to a world consumption of twenty-two billion kilowatt-hours, with a corresponding generating capacity of about 3,800,000 kilowatts; and the rate of growth is still rapid with enormous increases in prospect in the near future.

Despite opinion to the contrary, this kind of business can be supplied by public utilities. The electrochemical industry is interested in a cost of power of three-fourths of a cent or lower and in good locations for labor, raw materials and markets. At present it is prone to think of cheap power in terms of water-power generation only, and it is not aware of the fact that water power is becoming increasingly expensive and steam power increasingly cheap. In Germany a large amount of steam power is used for electrochemical purposes at a price of from 2.5 to 3.5 mills, and there are many locations in this country where a combination of power, labor, raw materials and markets can be used to better business advantage than a water-power plant on a distant site.

It will pay utility companies to study possibilities for electrochemical and electrothermic processes in their local area with the object both of getting existing industries to use new methods and of getting some of the large electrochemical groups to locate in the region. The business is growing rapidly and new products and processes are being introduced each year. In this country the output of furnace steel is about 700,000 tons, that of brass 675,000 tons, zinc 25,000 tons, and aluminum 750,000 tons. Many of these metal processes are of recent development. Adding to these the rayon industry, the molded composition groups, the plating group, the alloy group,

the phosphorus, chlorine and ammonia group, the possibilities of hydrogen and oxygen production and the many other products, there appears to be a very encouraging outlook for high-load-factor business. Co-operation, salesmanship and a recognition of actual conditions and possibilities are needed to bring a very desirable class of load to utility lines.

* * * *

Lightning Researches Under Way

THAT bugaboo of service reliability, lightning, is going to meet some very delicate instruments and some highly skilled experimental talent this summer. Several field researches are under way, and it is hoped that cathode-ray oscillograms will give the industry data on the magnitude, wave front, attenuation and frequency of lightning waves. It is unfortunate, however, that peak values will not be had because the flashover value of the lines is relatively low.

But after the data are recorded there will be opportunity for better economics and engineering in line design and in lightning protection. It will still be good practice to put lines in locations not subject to frequent storms, to build lines near the ground, to use ground wires that conform closely to conductors in their characteristics, and to adjust line and substation insulation values to conform with the devices available to protect against lightning. Even after the wave fronts and peak values of lightning waves are determined there will still be problems for engineers to solve. Lightning-arrester design will be stimulated to get a more effective device and one that can be used more frequently without excessive cost; devices to permit insulator strings to flash over without disturbing service will be developed; the insulation design of apparatus will be improved to care for the ranges of lightning voltages found in practice, and, above all, if data are complete, engineers will be able to design transmission lines to give a fairly exact and predetermined service that will be fixed by balancing dollars of revenue against the dollars required to build the line.

Every encouragement should be given the field research workers on lightning. There is much at stake, and the industry will reap a rich return when science replaces assumption in dealing with lightning phenomena.

* * * *

Attempts to Discredit Utilities Personally Affect Wage Earners

BECAUSE of the fact that individual utility companies with a few exceptions have so conducted themselves as to deserve the esteem of the population they serve, the Federal Trade Commission investigation has not destroyed the credit standing of utility securities. None the less, wage earners throughout the country should be brought to realize how they would be affected individually as well as collectively if political attempts to discredit utilities were to curtail the supply of the $900,000,000 of new capital which is needed yearly in the electric utility field.

Total suspension of this amount of capital investment in one year would affect five hundred thousand to six hundred thousand wage earners indirectly, if not directly, figuring on a basis of an average income of $1,500 to $1,800 a year for this class of worker. If this sounds impossible, it is because most men are accustomed to thinking of direct effects only. But not merely the labor employed in building generating stations, transmission lines, substations and so on is involved. Every piece of equipment employed has acquired its value between the raw state and the finished product by the application of labor, even where automatic machinery has been used, because labor had to be employed somewhere along the line to make it. Important as capital is, it has to be expended, directly or indirectly, on labor to add value to the raw products handled.

Probably the best way to give any one some conception of the effect of suspension of utility capital expenditures would be to trace just one piece of equipment back through the production machinery used along the line. Then consider how many merchants—butchers, bakers, clothiers, banks—would be affected by a curtailment in the amount spent by the wage earner.

If every utility could devise some way of graphically portraying this complex, ramified interdependence of human beings on capital expenditures and display the graph for the edification of the citizens in its community, it is doubtful whether any wage earner would without protest allow his political representatives to discourage the acquisition of new capital for an industry rendering so useful and valuable a service.

* * * *

Electrification Plans in Great Britain

AMERICAN engineers are always keen to learn of developments abroad and to adopt any helpful ideas that are evident in such progress. The present visit of Sir Andrew Duncan, chairman of the Central Electricity Board of Great Britain, and of Archibald Page, its chief engineer, serves to draw attention to the electrification plans now being drawn up and in part put into effect in that country. These plans differ from American practice in many particulars, and engineers on this side will follow their development with keen interest.

The whole of Great Britain has been divided into a number of districts for the purposes of power generation and distribution. These districts have been blocked out along natural geographical and industrial lines. For instance, the Central Scottish District covers the industrial section of Scotland surrounding Glasgow and Edinburgh.

The majority of the central stations of England are now municipally owned and operated. Hence their service extends only over a limited political district. This has resulted in the establishment of many small disconnected stations, all with low load factors and generally operating at low efficiency. They have much larger percentages of reserve boiler and turbine capacity than is usual in American plants. Lacking interconnection, their diversity of load is poor.

Under the new plan, the various power supply systems in each district will be tied together by an interconnecting transmission system known in Great Britain as the "grid." This will be built by government funds and will be operated by a government-appointed commission known as the Central Electricity Board. In this regard it resembles the Hydro-Electric Power Commission of Ontario. Frequency is to be standardized at 50 cycles. The diversity that will be introduced by such

interconnection will release much reserve equipment. The "grid" will furnish all electricity desired to the municipal authorities, who will distribute and retail the energy over their own systems. The Central Electricity Board will purchase such supplies of electricity as are required at agreed cost prices from the owners of certain selected stations which have been generally the largest and most economical in the district. The board can also authorize the construction of new superpower stations to furnish power to the grid as required. The board thus acts as a "wholesale middleman," buying electrical energy wherever it can be generated most cheaply and distributing it over any area requiring service. Old and obsolete stations will be shut down entirely or used for peak-load service only. It is expected that the economies that will result from this method of generation and distribution will exceed present costs by an amount which will eventually more than offset the cost of the new transmission and transforming equipment. Interconnection will also provide more reliable power supplies to consumers.

Progress has been made on the construction of a portion of the Central Scottish District noted above, where tower lines to operate at 132 kv. will be used. Work has also been started in other districts. Great credit is due to engineers of the Central Electricity Board who have successfully solved many intricate problems in the development of their schemes.

Some of the new central stations that are contemplated will compare favorably both in size and in economy with the best American stations. Load factors at present are low in Great Britain owing to the lack of aggressive commercial sales policies on the part of the municipalities. An adequate supply of electricity from the grid should encourage a wider use of electricity for all purposes, which would increase load factors and ultimately decrease costs to the British users.

The British representatives now with us will be interested in our interconnection problems and in our power-station developments. American engineers will give them every assistance in gathering the information that they desire and will endeavor to make their stay both pleasant and profitable.

* * * *

A Testimonial to a Civic Service

OUT of New York City comes a bit of interesting testimony, particularly pertinent in this season of "Light's Golden Jubilee," and from no less a source than the far-famed Commissioner Whalen of the Police Department. It arose from a controversy between the Fifth Avenue Association and the electric sign manufacturers, resulting from an attempt by the association to extend the ban against electric signs so that they would be eliminated from the cross streets within a certain zone on either side of certain sections of the Fifth Avenue shopping district. Fifth Avenue feels that by doing away with signs it has established an exclusive atmosphere that has strengthened its appeal to the "carriage trade," and it wants to absorb more territory. The sign manufacturers and other branches of the electrical business took up arms and the proposed ordinance has not been passed—but that's a local story.

In the course of the affray the sign men planned to stage a demonstration of the value of the street-lighting service that is a byproduct of electric sign advertising. They arranged to have 97 per cent of the great displays on Broadway darkened on a certain evening for three minutes at theater time. The demonstration was to have been advertised. Thousands of people were expected to come and see how dark the streets would be without electric signs. And then the police stepped in. Commissioner Whalen feared that it would throw the theater district into such darkness that traffic would fall into a hopeless tangle. He recognized that, though their purpose is purely commercial, these signs have come to perform a vital civic service that cannot be dispensed with. The demonstration was called off. The industry can point the moral.

* * * *

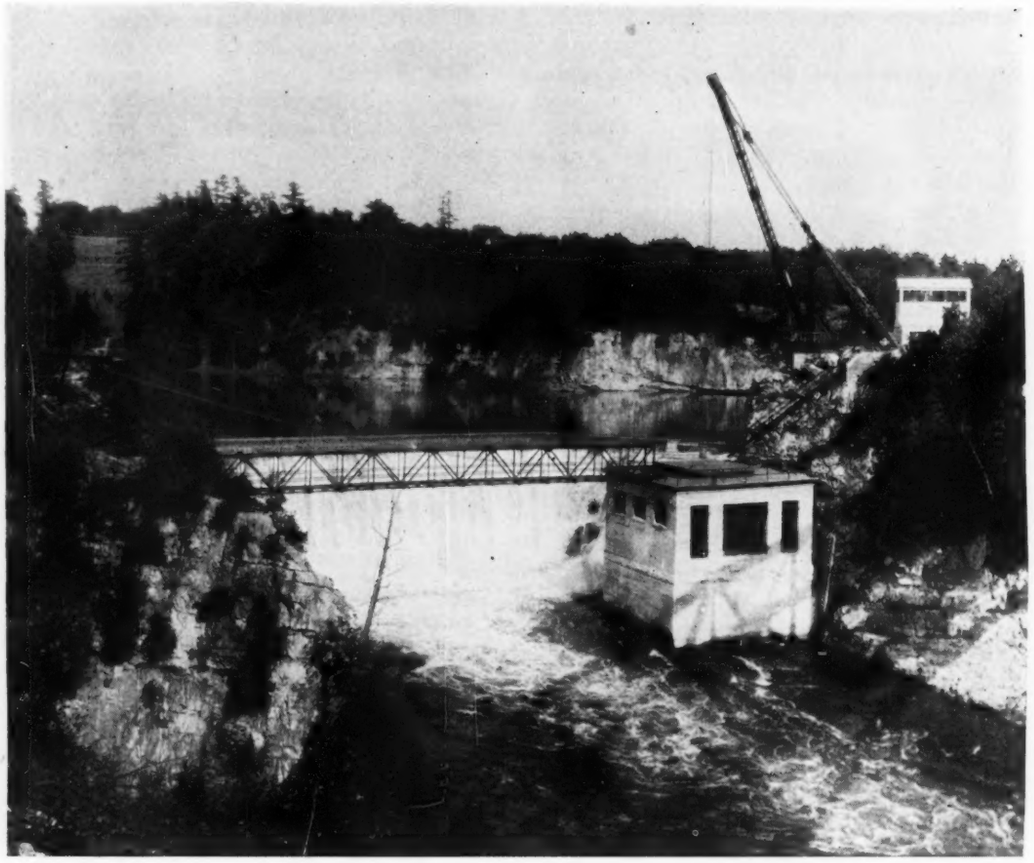
This Physics Labyrinth

SCIENTISTS and physicists are very humble these days. They are suffering the humiliation of knowing that they know little if anything about the fundamental facts of nature. All theory and experiment of the past twenty years has exploded in their hands to leave a heap of statistical facts. Any order they may possess is that of the labyrinth.

For some twenty years, for example, proofs accumulated that light has opposite qualities—that of wave rays and that of corpuscular rays. These contradictions could not be reconciled, so in 1925 de Broglie suggested that a moving electron was accompanied by a wave radiation. This got the Bohr structural atomic theory off a dead center by suggesting a wave process surrounding the atomic core. Later Davisson, Germer and Thomson proceeded to prove to themselves that only waves exist and that there are no corpuscles, matter being merely a wave system. This led to the thought that instead of human beings and fish we have the world populated with mermen and mermaids that cannot be described or controlled.

The trouble is that we demand that our experiments and observations fit into our conception or scheme of time-space to the smallest detail. Yet Planck showed that infinitesimally small observations cannot be made, because nature changes by jumps. Or, as Heisenberg puts it, a physical picture of the universe is impossible because of the nature of things. Thus the latest principle in physics says that that which can be localized in detail in space-time and that which is observable are not one and the same thing, as was formerly assumed. The wave conception is a symbol or representative of that which can be localized in detail. As Dr. Schrödinger states it, "it is the precipitation of all our efforts in this direction." The corpuscle (electron, light quantum, etc.) is the symbol of the small but always finite acts of observation. The waves cannot be observed, the corpuscles cannot be localized in detail. Yet the corpuscle is somewhere in the universe, and it may manifest itself suddenly in a finite act of observation—and this is the only means by which a wave may be observed. But it is impossible to identify that which is localized in detail in space and time with that which is observable. So where are we? Much theory, a great deal of nonsense and the latest mathematicians' formula for the universe await the advent of the genius that will give us a true picture of nature in terms of fundamental physics.

Derrick Simplified Construction of Winooski Plant



THE erection of the single-unit, 3,750-kva. hydro-electric plant of the Green Mountain Power Corporation (Vermont) in the gorge of the Winooski River was greatly simplified by the use of an electrically operated 40-ton, 60-ft. boom derrick. This material-handling equipment has been left in position for operating and maintenance work, being used in handling the reinforced concrete headgates and in the removal of equipment from the station itself. It is operated by a 75-hp. motor.

Electric Galvanizing

Close temperature control results in improved quality of product. Uniform heat distribution in metal bath. Long-hour energy use raises load factor and reduces unit energy rate

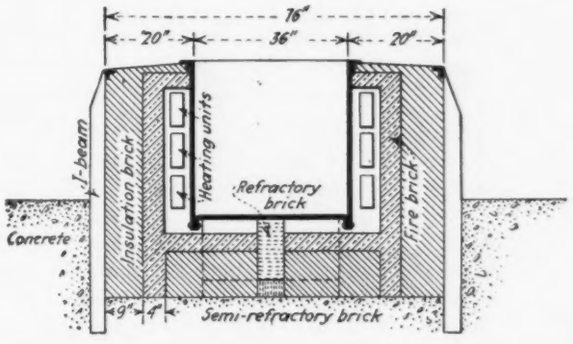
By Robert A. Clark, Jr.

Frank F. Fowle & Company, Consulting Engineers, Chicago, Ill.

THE advantages of electric heat in the galvanizing industry for heating the zinc tanks are being recognized and several installations are now in successful operation. Among the accredited advantages of electricity over coal, oil or gas heating are: (1) Uniformity of temperature, (2) ease of control, (3) reduction in maintenance costs, and (4) improved reliability. Recently installed electrically heated tanks range in size from about 25 kw. up to 400 kw. One of the latest and largest is in the plant of the Delta-Star Electric Company at Chicago, Ill. The tank, having a capacity for galvanizing 3,000 lb. of steel per hour and requiring 198 kw. at 220 volts, three phase, was started on May 28, 1928, and since has been in continuous service with practically no trouble or operating difficulty.

The heating elements and the control equipment were manufactured by the General Electric Company and the steel tank by the James J. Heggie Company, Joliet, Ill. The framework was fabricated from structural steel and the unit assembled by the Delta-Star Company. The tank itself is of 1⅛-in. steel boiler plate 3 ft. wide, 3 ft. deep and 15 ft. long and contains approximately 60,500 lb. of molten metal. It can be raised vertically out of the setting on the brick piers without disturbing the heating elements or insulation. The heating elements are so designed that the heat will be transmitted uniformly to the tank. Special precautions have been taken to prevent the possibility of "hot spots"; that is, places on the heating elements or on the tank where the temperature is higher than normal. This is a very important item in the successful operation of steel tanks containing molten zinc, because local overheating may injure the tank or cause bulging of the plate, and also because the rate of solubility of steel in hot molten zinc increases rapidly as the temperature rises above approximately 850 deg. F.

It will be observed that the lower heating element does not extend down as far as the bottom of the tank. This arrangement reduces the possibility of hot spots owing to the presence of dross, which is the accumulation of zinc-iron alloy on the bottom of the tank. However, the zinc dross cannot be permitted to accumulate indefinitely because it would rise sufficiently to impair the normal efficiency of heat transfer, thus resulting in hot spots,



Cross-Section of Tank Showing Arrangement of Heating Elements and Insulation

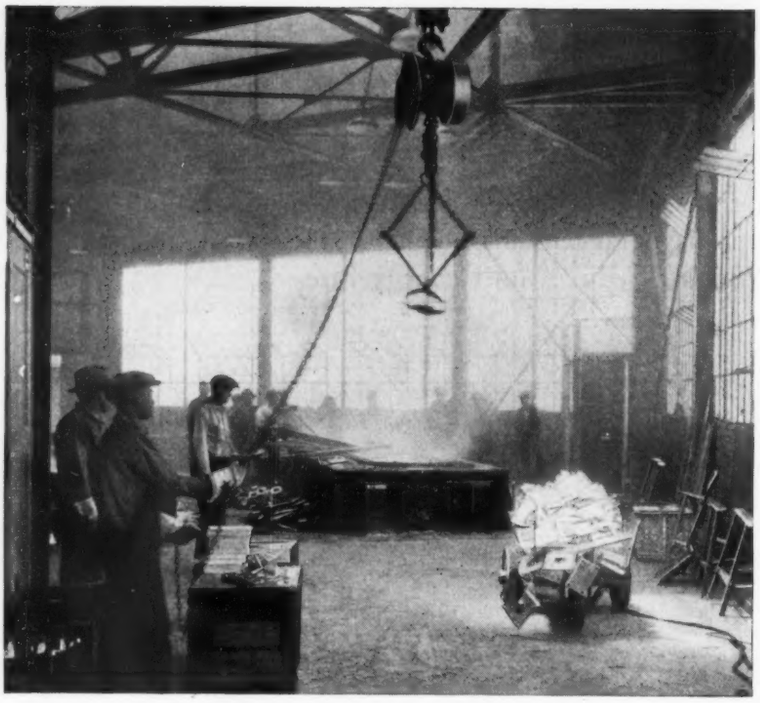
There are no heating units at the ends or bottom

Table I—Performance of Galvanizing Tank

Month (1)	Tonnage of Steel Galvanized (2)	Hours in Production per Month (3)	Gross Lb. of Zinc per Ton of Steel Galvanized (4)	Lb. Zinc Removed in Dross and Skimmings per Ton of Steel Galvanized (5)	Net Lb. of Zinc per Ton of Steel Galvanized (6)	Kw.-Hr. Consumed per Month (7)	Kw.-Hr. per Ton of Steel Galvanized (8)	Cost of Electrical Energy per Ton of Steel Galvanized* (9)
July	274	416			142	61,200	223	$2.90
August	271	434			140	65,500	242	3.14
September	292	385	See	See	157	60,900	209	2.71
October	194	326	Note	Note	155	50,300	259	3.37
November	193	275			122	41,800	217	2.81
December	203	326			149	51,600	254	3.31
Total six months	1,427	2,162	....	....	....	331,300	....	....
Average per month	238	360	185	40	145	55,200	232	$3.02

*Electrical energy is purchased at an average cost of 1.3 cents per kilowatt-hour.

Note:—On account of the dross and skimmings not being removed at the end of each month it is possible to obtain only the average amount of zinc in the dross and skimmings for the period.



Galvanizing Room in Delta-Star Plant
Control inclosed in steel cabinet in right background

with the detrimental effects previously mentioned. To facilitate its removal the dross is floated on a layer of lead, approximately 6,000 lb. being used in the tank. The dross is normally removed once a week.

In order that leaks in the tank may be detected, drains are provided underneath it; at the bottom of the drains are pairs of contacts connected to a gong and so arranged that any metal flowing over the contacts will short circuit them and ring the gong, notifying the operators of trouble.

As shown in the diagram of connections of the heating elements and the control equipment, the three-pole contactor is controlled by a pyrometer connected to a thermocouple located about midway between one of the heater elements and the tank. The pyrometer maintains the temperature at the thermocouple at any desired value within about plus or minus 5 deg. F. This, in turn, keeps the temperature of the molten zinc constant within about plus or minus 10 deg. F. under intermittent operating conditions. The pyrometer is adjusted to hold the temperature of the thermocouple at 1,030 deg. F., which maintains the zinc bath at approximately 850 deg. F. Somewhat closer control of the temperature variation could be had if the thermocouple were placed in the zinc bath. However, the possibility of trouble is greater with such a location, and, if the temperature variation is permissible, the best location for the thermocouple appears to be between the heating element and the tank.

The heater elements are so designed that the contactor will be closed and the current on about 80 per cent of the time when the tank is operating at full capacity. The triple-pole, double-throw switch connects the heating elements either delta or star, thus providing two heats, the low value being 33 per cent of the high.

The electrical input to the unit is 198 kw. when the heater elements are connected delta. The power supply is 220 volts, three phase, 60 cycles. The tank is rated at a galvanizing capacity of 3,000 lb. of steel per hour, although in actual operation this value has been exceeded considerably. In one nine-hour period a total of 15 tons of steel was galvanized, or an average of about 3,300 lb. per hour. In normal operation the pyrometer closes and opens the contactor about once a minute. As the electrical energy is measured on the basis of a 30-minute demand, the registered maximum demand is somewhat less than the maximum instantaneous demand; that is, 198 kw. The integrated demand for the month of September was approximately 168 kw.

During intervals when no material is being galvanized the zinc is covered with a layer of asbestos fiber on which are placed sheets of transite. This reduces the radiation loss by about one-half, while still maintaining the zinc bath at full heat.

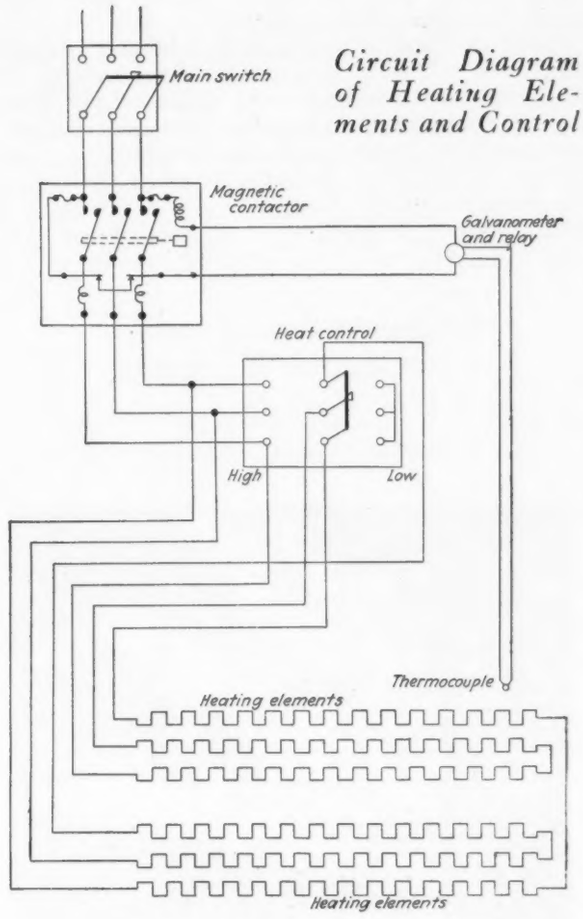
A heat balance for each monthly period computed from the theoretical heat required to raise the steel and the zinc to the temperature of the bath is shown in Table II. The difference between this energy and the electrical input is taken as the radiation loss. The theoretical radiation loss for six months, based on the average hourly loss, is shown in Table III. The computed hourly loss is 82 kw.-hr. when the tank is uncovered and 45 kw.-hr. when it is covered with asbestos. The theoretical loss as shown in Table III checks reasonably well with that shown in Table II and it therefore seems possible to compute quite accurately the operating characteristics and efficiency of any new installation from a heat balance based on the theoretical amount of energy required to heat the metal plus that lost due to radiation from the installation planned.

It should be observed that the cost of the energy on the basis shown in Table I may not always give a true picture of the savings effected by the use of electric heat,

Table II—Heat Balance

Month	Kw.-Hr. to Heat Steel	Kw.-Hr. to Melt Zinc and Raise to 850 Deg. F.	Total Useful Kw.-Hr.	Total Kw.-Hr. Lost and Radiated	Total Kw.-Hr. Input	Thermal Efficiency, Per Cent
(1)	(2)	(3)	(4)	(5)	(6)	(7)
July	17,000	1,880	18,880	42,320	61,200	30.8
August	16,800	1,870	18,670	46,830	65,500	28.5
September	18,140	2,210	20,350	40,550	60,900	33.4
October	12,050	1,455	13,505	36,795	50,300	26.8
November	11,980	1,135	13,115	28,685	41,800	31.4
December	12,600	1,465	14,065	37,535	51,600	27.2
Total six months	88,570	10,015	98,585	232,715	331,300	....
Average per month	14,762	1,669	16,431	38,786	55,217	29.8

Note:—Column (4) = Column (2) + Column (3). Column (5) = Column (6) — Column (4). Column (7) = Column (4) ÷ Column (6).



Circuit Diagram of Heating Elements and Control

because in some cases the energy consumed by the tank will reduce considerably the average cost of energy for the whole plant and a further evaluation must be made if a more accurate representation is desired.

For example, during the month of September the demand and energy requirements for the Delta-Star plant were as follows:

	Demand, Kw.	Energy, Kw.-Hr.
Galvanizing tank	168	60,900
Motor and other loads	180	34,300
Total	348	95,200

The total power bill for the month was $1,238.12, or an average of approximately 1.3 cents per kilowatt-hour. On the basis of the same demand and energy consumption for the motor and other load, the bill for the month would have been $647.95. This leaves $590.17 charge-

Table III—Theoretical Radiation and Convection Loss

Month (1)	Hours Uncovered (2)	Hours Covered (3)	Total Loss Uncovered, Kw.-Hr. (4)	Total Loss Covered, Kw.-Hr. (5)	Total Radiation and Convection Loss, Kw.-Hr. (6)
July	416	328	34,150	14,780	48,930
August	434	310	35,600	13,960	49,560
September	385	335	31,600	15,090	46,690
October	326	418	26,750	18,800	45,550
November	275	445	22,550	20,000	42,550
December	326	418	26,750	18,800	45,550
Total six months	2,162	2,254	177,400	101,430	278,830
Average per month	360	376	29,567	16,905	46,472

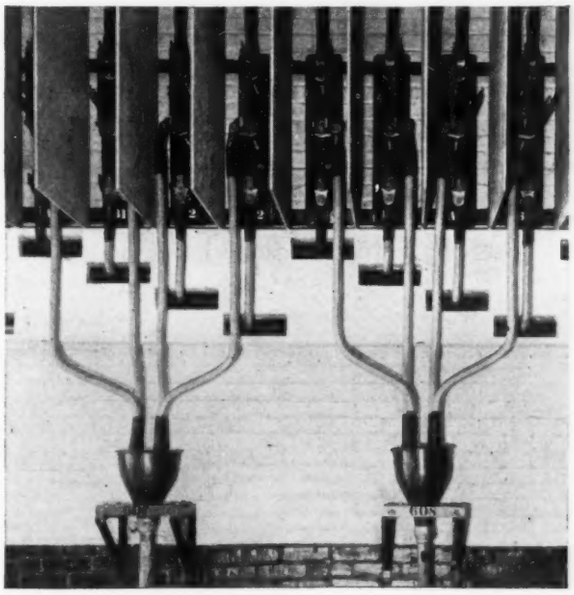
Note:—Column (6) = Column (4) + Column (5).

able to the galvanizing tank, or a cost of $0.0097 per kilowatt-hour.

The studies of energy costs made prior to the installation of the tank, and since confirmed by actual operation, indicated that electric heat would be more economical than any other heat source. Additional savings over other methods of heating have been noted, which include: (1) Reduction in dross, (2) improved coating, (3) less attention to operation and maintenance of tank due to completely automatic heat control. All of these factors considered together have demonstrated quite conclusively the merits of electric heat in the galvanizing industry and the use of electricity for this purpose may be expected to increase rapidly as the advantages become known.

Simplified Selector Switching Minimizes Interruptions

BY THE use of double-throw, double-bladed selector switches the Hartford Electric Light Company has materially simplified construction in its later substations. In the typical instance shown, the two-phase, 4,800-volt feeders now standard on this system are connected through outgoing cable potheads to the center terminals of selector switches mounted on insulating bases installed symmetrically above the potheads, and with suitable barrier protection between phases. The upper terminals of the selectors are connected through oil circuit breakers to the main bus on the floor above. The lower terminals are connected by short taps through slots and fiber duct to a transfer bus located inside a concrete monolith, as illustrated. The double-throw blading enables any feeder to be energized from the main bus



Double-Throw Selector Units Facilitate Maintenance

through the auxiliary bus without interrupting service. and the breaker normally controlling any circuit can be cut out of service for inspection or maintenance by disconnecting it from the main bus and the feeder. No spare breakers are required.

Remote Oil Switch Operation Saves Building New Line

By F. M. Lewis
Northwestern Electric Company, Portland, Ore.

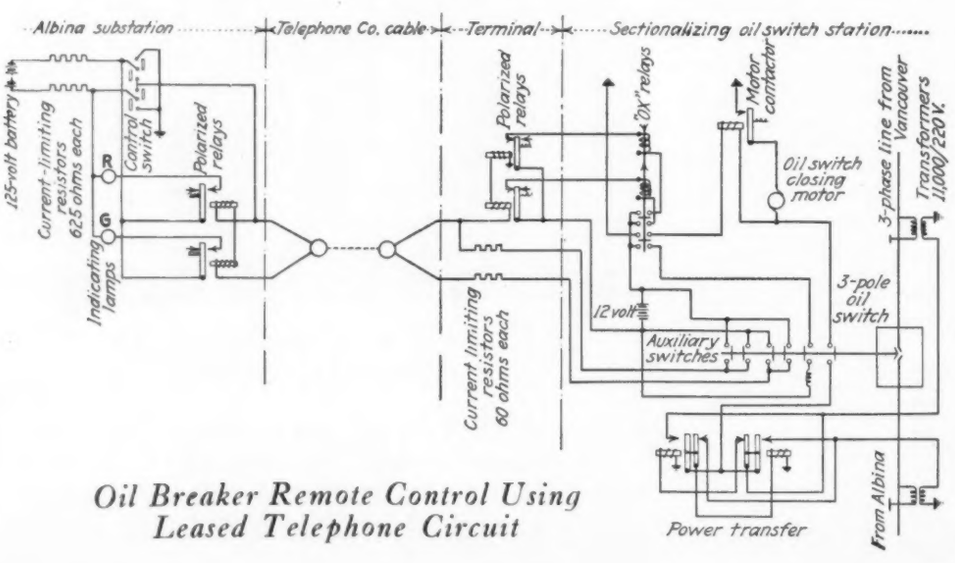
TO MAKE possible the use of a 10-mile tie line between two substations as two feeders normally and as a tie line in emergencies, the Northwestern Electric Company worked out a remote-control scheme for an oil circuit breaker in the center of the line which made a second feeder unnecessary. Normally the line serves as two feeders with the oil circuit breaker open, but should an emergency arise and it be desired to use the circuits as a tie line the operator at one end may remotely close the sectionalizing oil breaker.

The high cost of a control circuit on already crowded poles led to the renting of a pair of wires from the telephone company and adoption of the remote-control scheme shown in the accompanying diagram. The telephone company's requirements were that direct current not to exceed 0.1 amp. be used, making it necessary to use relays that would operate on this small current. Also it was necessary to protect the telephone line with current-limiting resistors.

Two polarized relays which will operate on 0.06 amp., connected in series, were used at each end of the telephone line. The relays at the control end operate red and green signal lights, indicating to the operator the position of the switch and also notifying him that a switch operation has been completed. The auxiliary switches on the oil circuit breaker change the polarity of the two telephone conductors so that one relay operates on a negative and the other on a positive current. Since the signal lights are continuously energized it was necessary to use a metallic circuit instead of a ground return to prevent interference with telephones.

A switchboard control switch connected as a pole changer controls the two polarized relays at the circuit breaker by sending out a positive impulse between one side of the telephone line and ground to close the switch and a negative impulse between the other side and ground to open it. The polarized relays control a type OX relay, which is an electrically operated double-throw switch. This relay in one position energizes the trip coil circuit, the trip coil circuit being opened by the circuit breaker auxiliary switch. In the other position the closing contactor is energized.

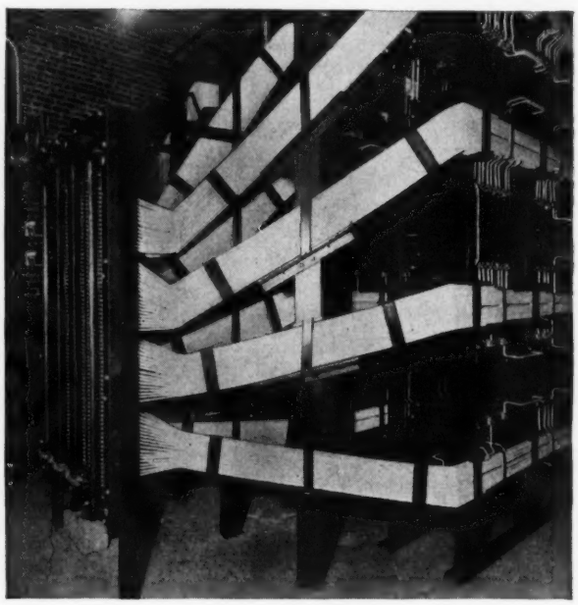
Power for operating the oil circuit breaker is obtained from two 11,000/110/220-volt transformers. The secondaries are connected to a single supply through magnetic contactors mechanically interlocked so that one transformer is always connected to the a. c. supply. Current for operating the relays is taken from the station storage battery. Current for the OX relay and signal lamps is provided by a 12-volt storage battery.



Oil Breaker Remote Control Using Leased Telephone Circuit

Compact But Accessible Control Wiring

By F. G. Preston
General Electric Company, Bloomfield, N. J.



AN UNUSUALLY well-executed wiring and installation job has been completed by the Consolidated Gas, Electric Light & Power Company of Baltimore, Md., to control its gas booster at the Spring Gardens plant. The control equipment consists of a controller and speed-regulating resistor used with a 500-hp., slip-ring motor with a maximum rating of 625 hp., driving a centrifugal compressor to boost illuminating gas pressure to an economical distribution value.

The controller is designed for 50 per cent speed regulation in 135 steps, this large number being necessary not primarily for fine-speed increments but to give low-voltage drop between switch segments. This is necessary in order to prevent burning and excessive maintenance work on the segments and contact plungers, the motor secondary voltage being 800.

Construction Costs

of 69,000-Kw. Steam Plant

Unit cost dropped from $180 to $136 in making second installation. Structural cost reduced from 49 to 39 per cent. Boiler plant, turbo-generators and electrical equipment constitute 28, 17 and 15 per cent of total

SOME interesting construction cost data have recently been prepared by an Eastern power company supplying energy to other utilities from a tidewater steam generating station placed in operation about 3½ years ago. These data were originally compiled in a form covering overhead charges as applied to the entire system, but these overheads are not included in the figures tabulated. Nevertheless the itemization of major field costs for this 69,000-kw. plant contains sufficient material to be useful in construction cost estimates by steam plant designing engineers and is so presented with the explicit qualification that such items as engineering and superintendence, legal expenses, interest and taxes during construction, land cost and other items making up total cost are omitted from the steam plant tabulations.

The station was built to produce wholesale power and the initial installation contained one 32,000-kw. turbo-generating unit and three 1,492-hp. oil-fired boilers.

SUMMARY OF CONSTRUCTION COSTS
(Overheads Omitted)

	Initial Installation (Contract 1)	Additional Plant (Contract 2)
Structures	$2,829,457.45	$856,530.00
Boiler plant equipment	1,147,957.65	1,516,670.00
Turbo-generator units	914,482.00	695,600.00
Electric plant—steam	373,096.79	309,220.00
Outdoor transformer station	479,175.44	293,000.00
Shop equipment	9,919.93	.....
Totals	$5,754,089.26	$3,671,020.00
Boilers, hp.	Three 1,492	Two 1,492
Turbo-units, kw.	One 32,000	One 37,000
Fuel	Oil	Pulv. coal
Prorated cost per kilowatt excluding overheads and land	$180	$99.40
Cost per kilowatt of plant without land and overheads after installation of second unit, stack, boilers and pulverized fuel equipment		$136.50

(Note—Approximate cost of station site was $159,120)

The building was constructed large enough to accommodate a second unit of about the same capacity as the first and the design provided for an ultimate development of about 180,000 kw. on the site.

Under "Contract 1," the first three boilers and first

Various Costs Associated with Initial Installations of Three Boilers, One Main Turbo-Generator and Fuel Oil System (Contract 1)

Structures	
Wharf and bulkheads	$347,381.05
Dredging	104,273.63
Dam and pump house	30,432.16
Pipe line for fresh water supply	107,239.13
Station yard	146,661.78
Building	1,403,154.31
Stack foundations	5,699.25
Concrete stack	20,402.39
Condenser tunnel system	313,652.87
Piping and covering for compressed air lines	3,415.51
Fuel oil handling equipment	17,707.88
Switchgear and wiring	133,481.29
Crane, compressed air equipment, service pumps	52,714.18
Fuel oil storage plant	89,662.10
Yard work (cable tunnel, etc.)	16,223.76
Compartment doors in substation tunnel	896.52
Transformer repair house	41,459.64
Total structures	**$2,829,457.45**
Boiler Plant Equipment	
Fresh water supply pumps and piping	8,392.83
Auxiliary foundations	6,331.72
Boilers, superheaters, settings, soot blowers, etc.	370,852.68
Breechings, forced and induced draft system	116,025.25
Feedwater system, including heaters, economizers	159,051.53
Steam and exhaust piping	270,873.14
Fuel oil pumps, heaters, meters, strainers, piping	48,569.83
Ash hopper and lining	38,032.15
Indicating and recording instruments	25,582.42
Priming pumps and painting equipment	3,731.47
Testing and preliminary operation	18,446.55
Fuel oil pumps, piping, excavation, boxing, manholes	82,068.08
Total boiler plant equipment	**$1,147,957.65**
Turbo-Generator Units	
Turbine foundations	58,065.40
Condensers, supports, circulating water piping	250,665.40
Generating and exciter units	$560,142.71
Air cooler and pumps	15,824.79
Air ducts	2,069.25
Lubricating oil system and painting equipment	16,646.51
Preliminary operation and tests	11,067.94
Total turbo-generator units	**$914,482.00**
Electric Plant-Steam	
Steam-driven exciter equipment	14,054.68
Station service transformers and trucks	22,111.42
Potential regulators	1,924.17
Switchgear and wiring*	318,112.31
Indicating and recording instruments	8,527.48
Painting above	988.12
Preliminary operation and tests	7,378.61
Total electric plant-steam	**$373,096.79**

*Including main switchboard, $23,565.67; exciter panel switchboard, $4,390.64; control battery panel, $2,254.72; storage battery and racks, $3,428.01; battery-charging equipment, $2,635.11, and oil circuit breakers and sub-cell disconnecting switches, $24,760.93.

Outdoor Transformer Station at Plant	
Foundations	$40,195.43
Main power transformers and trucks	146,103.56
Oil piping, tanks and pumping equipment	17,237.63
Oil circuit breakers and bushing type current transformers	109,225.47
Disconnecting switches	32,348.06
Instrument transformers (potential)	12,677.78
Structural steel supports, main arbor	42,438.21
Lightning arresters and choke coils	30,024.29
Conduit, wiring, bus work, etc.	48,925.01
Total outdoor substation	**$479,175.44**
Shop Equipment	
Machine shop equipment	9,919.93

Various Costs Associated with Installation of Two New Boilers, a Turbo-Generator and Pulverized Fuel System (Contract 2)

Structures	
Dredging for wharf extension	$32,100.00
Bulkhead and wharf, extension 180 ft.	94,530.00
Station yard	78,725.00
Alterations to station, including 24-ft. extension to electrical bay	163,500.00
Turbine and auxiliary foundations	25,450.00
Pulverized fuel building including plumbing, heating, lighting, fire protection and concrete tunnel to boiler house	322,800.00
Breaker house complete (building)	91,650.00
Storeroom complete (building)	47,775.00
Total structures	**$856,530.00**
Turbo-Generator Units	
One 37,000-kw. turbo-generator, one 175-kw. motor-driven exciter, air coolers and housing	498,750.00
Condenser system, including one 45,000-sq.ft. surface condenser with auxiliaries, circulating water piping and revolving screen	156,250.00
Indicating and recording instruments, lubricating oiling system, service pumps and painting	40,600.00
Total turbo-generator units	**$695,600.00**
Electric Plant-Steam	
Station service transformers	14,260.00
Switchgear and wiring (main station)	190,400.00
Switchgear and wiring (pulverizing plant)	68,500.00
Switchgear and wiring (breaker house)	35,660.00
Switchgear and wiring (storeroom)	400.00
Total electric plant-steam	**$309,220.00**

Boiler Plant Equipment	
Boiler plant, including two 1,492-hp. boilers with superheaters, settings, pulverized fuel feeders, burners and soot blowers; also remodeling the three existing boilers for pulverized fuel	455,600.00
Draft system including one 200-ft. x 17-ft. concrete stack, uptakes and flues; four 40,000-c.f.m. forced draft fans; two 115,000-c.f.m. induced draft fans with ducts, combustion control and soot removal	186,500.00
Feed water system, including two feed water heaters, deaerators, economizers, regulators, etc	83,000.00
Piping and covering	124,800.00
Coal and ash handling equipment	212,000.00
Fuel oil handling equipment	500.00
Pulverized fuel equipment, including mills, exhausters, separators, air washer, transport system, tanks, piping	244,600.00
Coal tower, capacity 400 tons per hour	88,070.00
Coal tower trestle	53,000.00
Coal storage and handling equipment, including reclaiming hopper, hoist house, drag line scraper, track work and locomotive crane	57,500.00
Electrical work from breaker house to coal storage	$11,100.00
Total boiler plant equipment	**$1,516,670.00**
Outdoor Transformer Station	
Yard work, cable tunnel, lighting and drainage	13,900.00
Equipment foundations and arbor foundations	7,200.00
Electrical equipment, including three 15,000-kva. transformers	126,400.00
Switchgear and wiring	145,500.00
Total outdoor substation	**$293,000.00**

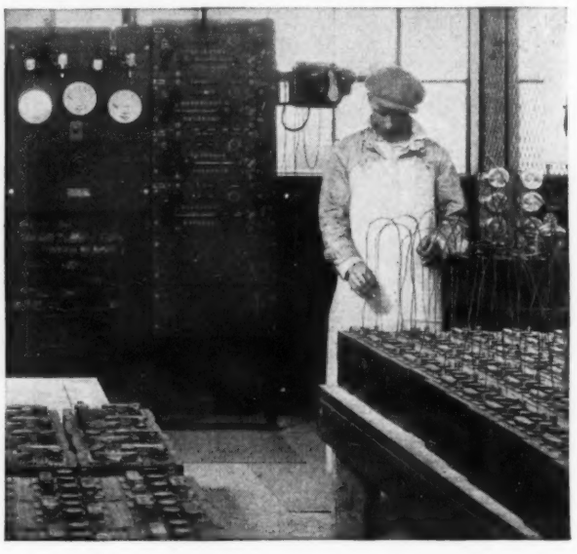
turbo-generator were provided, with 37,500 kva. in transformers to step up the potential from 14,000 to 70,000 volts for transmission to other points. A reinforced concrete stack 200 ft. high and 17 ft. inside diameter was built and a complete fuel oil storage and handling system was provided, with two 55,000-bbl. tanks. A 100-ton crane was installed in the power house and a 30-ton crane in the outdoor transformer station adjacent to the plant. A fresh water supply system was also built. The figures given under "Contract 1" therefore include various (though not total) costs which are of interest in the company's compilation of its outlays for construction and equipment in connection with the erection of the power house, first unit in boiler plant and turbo-generator outfits, oil-burning installation and outdoor substation for disposing of the initial output.

About a year ago "Contract 2" was undertaken and at the time these figures were prepared was 95 per cent completed. With respect to the power house and outdoor substation it included the addition of a second turbo-generating unit rated at 37,000 kw., two more 1,492-hp. boilers, three 15,000-kva. transformers and necessary electrical equipment in plant and outdoor substation, pulverized coal storage, handling and reclaiming equipment and the installation of pulverized coal burning apparatus on all five boilers. Six 70,000-volt circuits leave the plant's outdoor substation, which is of the double high-tension bus type.

Wires Melted Into Lead Studs for Connecting Batteries

WHERE a large number of storage batteries are charged at one time, such as in an automobile assembly plant, some method of connecting the batteries in series other than by the use of clips and jumpers is desirable to eliminate the troubles with corrosion, poor contact, etc., experienced with clips and jumpers.

In the new assembly plant of the Willys-Overland Pacific Company at Los Angeles series connections are made between batteries to be placed on charge by heating the ends of large U-shaped No. 16 bare copper jumper wires in the flame of an acetylene torch and melting them into the lead terminals. The flame is so intense that the end of the wire is almost instantly heated to a white heat and when jabbed into the lead terminal it will "freeze" solid in a second's time. After the batteries are charged the jumpers are removed with a pair of angle-cutting pliers or the wires are simply broken off flush with the lead studs at the point where they have become crystallized.



Copper Jumpers Fused to Battery Posts Improve Charging Conditions

This method of making connections is fully as quick as when using clips and jumpers and, moreover, insures a good low-resistance electrical connection between the various units in the assembly.

Cable Performance and Practice*

Tests after cable is in service. Possibilities for improvements in joints and potheads. Applications of oil reservoirs. Sheath bonding and insulating joints. Summary of present tendencies and practices

By Herman Halperin

Head Engineer Technical Division, Street Department, Commonwealth Edison Company, Chicago, Ill.

IN 1928 fifteen large utility companies in the United States reported to the N.E.L.A. subcommittee on cable operation that they had cable-testing sets. Ten companies had both alternating-current and direct-current sets, while four had only alternating-current and one had only a direct-current set. The total was 58 testing sets, of which two-thirds were stationary and the balance portable or semi-portable. The alternating-current sets ranged from eight to 1,000 kv. (the latter voltage is available only for testing short lengths of cable on station property) and the direct-current sets, which were kenotron outfits, ranged from 30 to 400 kv. in test voltages and 0.05 to 2 amp. in capacity.

In order to make equivalent d.c. tests, the specified a.c. test voltages are usually multiplied by a figure between 2 and 2.4, the latter figure being the value used in the A.E.I.C. cable specifications. Most of the companies used the testing sets for making tests on lines during installation and upon completion of a line and proof tests whenever changes were made in the line after it had gone into service. Usually the test voltages employed for proof tests were 125 to 150 per cent of the operating voltage.

Seven of the companies made periodic proof tests on at least a portion of their cables at intervals of from one to twelve months, for the purpose of reducing the number and severity of failures in service. This practice has been of considerable benefit in eliminating defects in underground lines at chosen times for cables which have fair or poor insulation, especially when impregnated with considerable rosin. Modern cables having an impregnating compound with a mineral base usually have not given satisfactory indications of incipient trouble with a.c. tests or even with d.c. current-time tests, and failures have occurred in several instances very shortly after tests had indicated no trouble. In general, it seems that a reasonable frequency for making these periodic tests is once every six months.

When the Commonwealth Edison Company began an investigation seven years ago as to whether or not in-

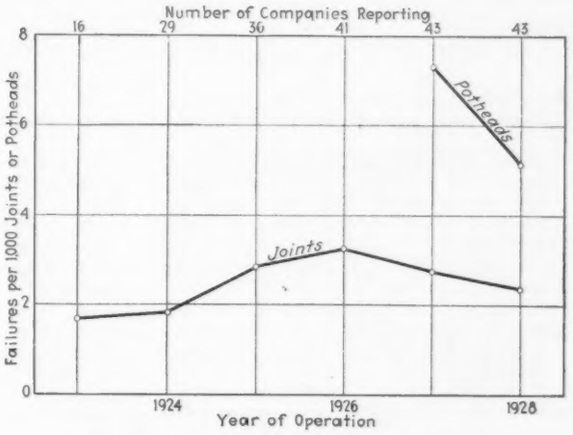


Fig. 1—Rate of Failures in Joints and Pothead

The graph which applies to 6,600-volt operation and higher is based on data from the annual reports of the subcommittee on cable operation to the underground systems committee, N.E.L.A.

**An analysis of cable failures in the United States and progress in design and operating practices were presented on page 1093 of the June 1 issue.*

The oil-filled type of construction appears at present to be desirable for single-conductor cables rated at 110 kv. and higher, but the proper border line voltage for oil-filled cables as distinguished from cables of ordinary construction is indefinite on account of the continual progress being made in both types of construction.

Periodic proof tests are of value for cables having fair or poor insulation, especially on systems where the failure on one line causes other lines to be disconnected from the system.

By the combined use of proper design of joints, including the specification of proper materials, with first-class construction by splicers having a full appreciation of all of the points of good workmanship, the rate of failures in joints can be made a small fraction of one failure per thousand joints per year.

The use of a thin oil for filling joints appears advantageous for joints rated at 33 kv. and higher.

With such joints, an oil reservoir should be provided of ample capacity to take care of variations in oil flow from the joint into the cable at a minimum maintenance expense.

Such reservoirs containing no air and under a positive pressure appear to be advantageous, but cannot be relied upon to obviate the possibilities of void formation in cables of ordinary construction.

For extra-high voltage joints made on cables of ordinary construction there are attractive possibilities in using a shielded type construction and a non-migrating heavy filling compound.

For single-conductor cables on a.c. lines, especially for cables separated as in ducts, a considerable increase in carrying capacity and reduction in operating losses are obtained by using insulating joints and special bonding instead of ordinary joints with solid bonding.

cipient faults could be detected by d.c. current-time tests on 12-kv. cables especially, the 12-kv. system was such that when one cable failed there was a great chance that other lines also would trip open due to the transient conditions. These periodic tests were begun a few times and it was found that failures occurred in lines shortly after tests had shown the cable to be "satisfactory." In recent years the 12-kv. system has been rearranged so that practically always the failure of a line results in only that line being disconnected from the system, thereby decreasing the magnitude of the effects of cable failures. In view of this system improvement and the ineffectiveness of the tests the periodic tests have been discontinued.

Two companies have recently started making periodic dielectric loss tests on installed lines for the purpose of discovering, if possible, a reliable indication of any changing conditions of cable insulation or of incipient failures.

Approximately 15 per cent of all the cable failures in 1928 occurring after lines had been placed in service were caused by tests on the lines. It is interesting to note that these test failures were divided in approximately the same proportion as to inherent and non-inherent causes as were the total failures.

Although the total rate of failure in cables and joints in the United States had decreased in 1928 to twelve per hundred miles per year, the rate was still high.

In the past few years a considerable improvement has been made in paper-insulated cables of ordinary construction as evidenced by a material reduction in the failures due to inherent causes.

A practical and reliable test is needed to determine whether or not impregnated paper insulation will remain stable in service.

Impregnated paper insulation is used almost entirely in the construction of underground cables to the exclusion of the use of varnished cambric and rubber insulation.

Considerable improvement in operation can be made by reducing the number of failures due to non-inherent causes, which have heretofore resulted in the major portion of the failures.

For three-conductor cables operating at 22 and 33 kv., the shielded type of construction is preferred to the belted type.

Single-conductor cable appears desirable for the transmission of large blocks of power, especially at extra high voltages.

Joints and Potheads

In recent years there has been a material improvement in the operation of joints and potheads (Fig. 1). The rate of joint failures in 1928, however, was still above the rates for 1923 and 1924, probably because of the troubles that have been experienced with three conductor belted cables operating at 15.1 to 35 kv. The rates of failures for this class per thousand joints for paper-insulated and for varnish cambric and rubber-insulated cables were 4.5 and 9.7, respectively. On the other hand, single-conductor cables operating at more than 35 kv. had the same rate of failures as the average for all high-tension joints, indicating that no unusual troubles are apparent with the use of extra-high-voltage single-conductor joints.

The rate of failures for potheads is more than double the rate for joints, and since the problem of pothead construction is quite similar to joint construction, apparently there is considerable room for improvement in their design and construction. A problem recently encountered is the migration of the thin impregnating compound in cables of recent manufacture forming dry spots at the bottom of potheads which are filled with hard compounds. There have been some failures under such potheads.

Several years ago the Commonwealth Edison Company realized that the workmen did not fully appreciate the instructions which had been given them on good workmanship in making joints and that such full appreciation was necessary, especially in connection with the installation of joints operating at 33, 66 and 132 kv. A series of lectures and demonstrations was given to them, therefore, in the spring of 1925, and also in 1928, to demonstrate the effects of poor workmanship. Also, in the past few years engineers have been used extensively in the field for instructing splicers and foremen on good methods of construction.

Another policy followed was that all joints should be so designed as to be stronger than cable in accelerated life tests. This practice led to the development of a better filling compound in three-conductor, 12-kv. joints in 1925 and to the adoption of the use of applied insulation in the crotch of the three-conductor joint in 1928. In 1926, when the installation of 66-kv. cable was begun in Chicago, the men were required to make practice joints which were all subjected to accelerated life tests. Twenty splicers were trained at the beginning of this work and not one of their test joints of the regular type failed before the cable failed.

The results of all these steps are well illustrated by operating results obtained on the 500,000-circ.-mil three-conductor, 12-kv. joints, which are the usual joints made on the transmission lines at generating station voltage on the Commonwealth Edison Company's system. For 1928 the rate of failures in the 4,120 joints made in 1924 or earlier was 4.9 per 1,000 joints per year, while the rate for the 7,300 joints made in 1925 or later was only 0.3. Two-thirds of the failures in the older joints were due to defective workmanship, while one-half of the failures (one joint) in the later joints were due to this cause. On the 2,200 66-kv. oil-filled joints and 195 132-kv. oil-filled joints that have been in operation from one-half to two and one-half years no failures have occurred in service or test.

Operating experience and tests have indicated that for extra-high-voltage joints and potheads, especially those operating at 33 kv. and higher, the use of an oil which has a congealing point of minus 10 deg. C. or lower is highly advantageous from the standpoints of maintaining high electrical strength of the piece of apparatus and for causing oil to migrate into the cable insulation. On recent installations the use of such an oil has been common. Since the oil will usually migrate into the cable, it is necessary to provide some kind of a reservoir so that the joint or pothead will be entirely full of oil at all times. This subject is further discussed in the next section of the article.

It appears, however, worth while to consider the use of a shielded joint filled with a highly viscous compound. In such a joint either impregnated paper tape or a high-

grade varnished cambric tape is applied to the two ends of the cable in the joint so that the built-up thickness is sufficient of itself to withstand the electrical stresses. Over the applied tape, which is tapered at the ends, a metal covering, such as copper braid or lead foil, is applied and connected at the ends of the joint to the cable sheaths. The joint is filled with a heavy compound which will not migrate into the cable.

Such joints have been used successfully in large numbers on the 60-kv. system in Paris. The advantages are:

1. The costs of the oil reservoirs and accessories are eliminated.
2. The operating costs in connection with maintaining these reservoirs and keeping the joint full of oil are eliminated.
3. The possibility of undue sheath expansion caused by cumulative migration of oil into the cable is eliminated.

The disadvantages of a joint filled with a semi-hard compound are:

(a) Improvement of the cable insulation near the joint by the joint-filling oil is not obtained.
(b) The possible general aid of the oil reservoir system in maintaining the initial impregnation of the cable insulation is lost.
(c) If the wipes of the joint sleeve contain minute holes and a vacuum is formed in the joint, then there is more chance of air and moisture affecting the insulation than with a joint filled with oil operating under a pressure.

2. The gravity type, consisting of a tank usually about half full of oil and the remaining space filled with air or other gas sealed off from the outside.
3. The pressure type, which consists of a tank containing hollow cells surrounded by oil. When the reservoir is full, the gas-filled cells are collapsed by the pressure in the oil, which initially ranges from 5 to 15 lb. per square inch, depending upon the particular installation. As the oil leaves the reservoir the cells expand, with the result that there is an accompanying drop in pressure. (Recently there has been a reversal of this type of reservoir for some work; that is, the cells are filled with oil and they are surrounded by gas.)

The sylphon type of reservoir has been found adequate where lines were moderately loaded, but where the lines were subjected to approximately full load the reservoirs which had a capacity of only six points would lose all of their oil in a very short time during cooling of the line. During heating of the line, the expansion has been so great in some cases as to break the reservoir. In some instances either springs with limiting stops have been constructed inside the reservoir or weights have been put on top on the outside of the reservoir. Larger sylphons having an active capacity of about ten pints have been used to advantage.

The Commonweath Edison Company has used the gravity tanks successfully for three years on three-conductor and single-conductor high-tension lines. The internal volume of the tanks is about 3 gal. where a tank is used for one joint and 6 gal. where used for three joints on a single-conductor three-phase line (Fig. 2). These tanks are approximately half filled with oil and the remaining space filled with air sealed off from the outside. Some special work is now being done in connection with replacing the air in and above the oil by nitrogen which would be initially under a pressure of approximately 10 lb. per square inch. Nitrogen was selected because it would considerably reduce the possible ill effects of the gas in the oil which would migrate into the cables. Another advantage is that the oil in the tank would be under positive pressure, whereas in the older system the air in the tank was left at atmospheric pressure and during operation vacuum was formed during the migration of oil from the tank.

It has been the experience of the Commonwealth

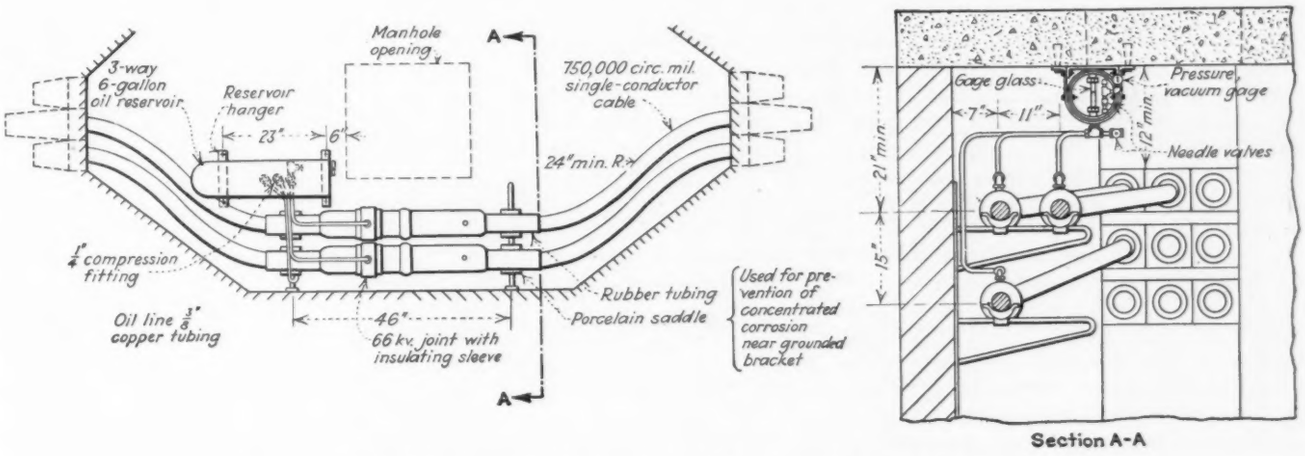


Fig. 2—Manhole Installation of 66-Kv. Single-Conductor Coil

Bonding connections and fireproofing are not shown in this Commonwealth Edison installation. The 66-kv. cables are insulated from each other and all other cables in the manhole by the rubber tubing over the cable and by the porcelain saddles. The cables are insulated from the reservoir by connection to nipples in the middles of the joint insulating sleeves. Insulated bond wire, connected to the cables 3 in. beyond the rubber tubing, is used in all manholes, except for solid bonding where bare wire is used. The bond wires are trained along the wall and supported by a pipe clamp. The cables are fireproofed as indicated in Fig. 8 on page 1098 of ELECTRICAL WORLD of June 1. Where oil lines are 4 in. or closer to the 66-kv. joints or cables, they are covered by rubber tubing to diminish possible a.c. electrolysis corrosion. The oil lines are fireproofed with ½-in. braided asbestos tubing.

OIL RESERVOIRS

According to the report of the subcommittee on cable operation, N.E.L.A., 553 miles of high-tension cable was equipped with oil reservoirs at the end of 1928 as compared with 369 miles at the end of 1927. The rate of joint failures was practically the same as that for all joints, but the rate of the cable failures due to inherent causes was 2½ times as much as for all cables. This may be explained by the fact that cables equipped with reservoirs have been extra-high-tension cables, in which the stresses are very high, or cables with poor insulation, for which, without the reservoirs, reductions in the operating voltages would have been necessary.

The principal types of reservoirs in use are as follows:

1. The sylphon type, which is similar in construction to an accordion. It is supposed to expand or contract as the oil enters or leaves the reservoir.

Edison Company, whose cables are usually installed in conduits with practically no slope, that the oil travels from a few feet to approximately 30 ft., as discerned by the feel of the insulation and the appearance of the oil in the cable. Other companies, especially those having three-conductor cables with only fair or poor impregnation, have found that the oil can be made to travel considerably farther in the cable and thereby effect a material improvement in the cable insulation. For modern cables which generally have good impregnation, the experience of the Commonwealth Edison Company with 2,500 oil-filled joints indicates that filling the joints with a thin oil is of importance for extra-high-voltage joints,

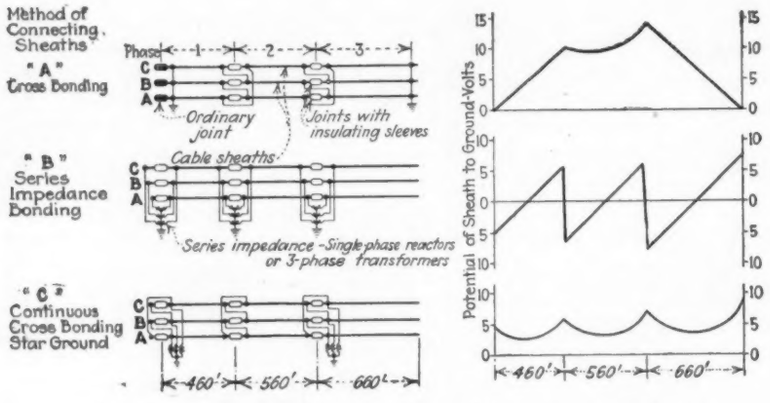


Fig. 3—Comparison of Bonding Connections and Resulting Sheath Voltages

Methods "A" and "C" are being used on Commonwealth Edison Company work in 1929. Cable data—66-kv., three-phase, 60-cycle, 750,000-circ.mil. single-conductor cable, with ⅜-in. insulation and 9/64-in. lead sheath cables arranged flat with 6 in between centers; voltage profiles for 60,000-kva. load; profiles for connections "A" and "C" are for sections 1-C, 2-B and 3-A, and profile for connection "B" is for outer cables.

but that for such a filling oil, even with ordinary pressure on the oil, it cannot reasonably be expected that such installations at the joints will be of material benefit to insulation in the middle of a length of cable. The resistance to the flow of the oil along the longitudinal path to a point in the middle of the length 200 or 300 ft. from the joint is considerable. Even where there are fairly free channels provided for such a flow, the resistance to radial flow through the insulation is tremendous. In cables of ordinary construction having "solid" insulation impregnated with very thick or viscous compounds, as distinguished from thin oils, apparently the flow will be much too slow to eliminate the possibility of void formation during contraction of insulation where there is a decrease in the conductor current and heating.

The company's experience with gravity tanks has shown the following:

1. The thinner the cable impregnating compound the greater is the migration of oil from the joint into the cable. For instance, on two 33-kv. three-conductor lines in the past three years the average total amount of migration of oil from the joints for one make of cable impregnated with a heavy resinous compound having a pour point of 40 deg. C. has been one pint, while in the other case, where the flow point is minus 5 deg. C., the figure is 22 pints.
2. The amount of migration is approximately proportional to the maximum range of operating temperatures.
3. With the comparatively higher conduit temperatures reached in the summer, the rate of oil flow into the cable decreases and sometimes reverses.
4. Joint oil has traveled a few hundred feet in lengths of cable where portions of the lengths have vertical drops of 65 to 85 ft.
5. No measurable increases in over-all diameters have been found for cables installed in practically horizontal conduits.

The pressure type of reservoirs has been used extensively. These reservoirs usually have an active volume of 3 gal. of oil for pressures between 15 and 0 lb. per square inch. By means of a pressure-volume curve and a small pressure gage attached to the outet nipple it is possible to determine the active volume of oil in the reservoir at a given time. The obvious advantages of this type of reservoir are that there is a large volume of oil in a rugged container and that the oil is under pressure and is not exposed to air.

The Commonwealth Edison Company is using the pressure type reservoir for feed to 66-kv. joints where the water level is normally within a few feet of the manhole roof and the gravity tank would be rather inaccessible. In such cases a pipe line is brought from the reservoir to within the neck of the manhole and a pressure gage and a filling nipple are attached to the pipe at this point.

General experience indicates that the higher the pressure on the oil in a reservoir the higher will be the rate of flow of oil into the cable. For well-impregnated cables it seems that whenever pressures are put on the oil in the reservoirs initial values of 10 or 15 lb. per square inch are desirable from the standpoint of working as much as possible of the filling oil into the cable during the initial changes in the structure of the cable on account of heating and cooling and on account of gas spaces that exist initially in the insulation. However, after several months of operation, especially in the summer time, when there is a tendency for the oil to flow back into the reservoir and increase pressures, it seems desirable that the maximum pressures in reservoirs be decreased to a lower value, such as 5 or 8 lb. per square inch. The continuation of operating pressures of 15 lb. per square inch may lead to excessive pressures in the summer time and also to gradual stretching of cable sheaths on account of the increased oil inside the lengths of cable sheath.

Solid and Special Bonding

In recent years it has been the practice in this country to bond all lead-covered underground cables in every manhole. The Commonwealth Edison Company uses a No. 6 stranded tinned copper wire for this purpose. No. 2/0 wire is used in special cases, such as connections to drainage cables and in the manholes adjacent to a substation. All high-voltage cable sheaths are connected to the ground bus at the line terminals. Direct-current 115-230-volt cable sheaths are connected to the neutral bus in the substations. All cable sheaths are connected to the negative bus in railway substations, usually through a switch and ammeter. Where two utilities have cables in the same conduit run, all cables should be bonded together. The purposes of all such complete bonding are, first, to provide a path of minimum impedance for failure currents to return to the line terminals and thereby prevent any excessive voltage rise on the cable sheaths during failures and, second, to minimize the possibility of positive d.c. potentials on the cable sheaths if they become isolated from other cable sheaths.

For multiple-conductor a.c. cables (and d.c. cables there is no voltage induced along the length of the cable sheaths. In single-conductor a.c. cables, however, there is a voltage induced in the cable sheaths which, if the

cables are solidly bonded in line with past practice, will send a current through the sheaths and cause heat losses. If the cables are installed in separate ducts, the sheath losses will range from 25 to 300 per cent of the conductor losses, thereby causing a considerable decrease in the carrying capacity and increasing the operating costs for the cable. With single-conductor cables in contact and the sheaths solidly bonded, the sheath losses will range from 1 to 20 per cent of the conductor losses. The losses vary approximately directly as the square of the conductor current, frequency, load factor and logarithm of cable spacing, and inversely as the sheath resistance.

Insulated Sleeves Eliminate Sheath Losses

In this country the cases in which three single-conductor cables have been installed in contact have usually been that of cables rated at about 12 kv., there being one case of such an installation at 45 kv. In such cases the cables have been solidly bonded. In view of the fact that, with cables separated as in ducts, the elimination of sheath losses will result in an increased load rating of 15 to 80 per cent and decreased total cable losses of 20 to 75 per cent, the industry in the United States has taken steps which will practically eliminate the sheath losses by the installation of insulating sleeves in the joints and the use of special bonding. This type of construction has been generally followed for single-conductor cables installed in ducts since 1927 and one company is planning a change on some of its older 66-kv. lines from ordinary joints and solid bonding to insulating joints and special bonding.

With the prevention of the flow of sheath currents, the induced voltages are left unneutralized on the sheaths. These voltages vary logarithmically with the ratio of the distance between cable centers to the sheath radius, directly with the frequency and magnitude of the conductor currents, and directly with the length of section between insulating joints.

The Commonwealth Edison Company has two standard sizes of single-conductor cables, namely, 750,000-circ.mil, 66-kv. cable having 24/32-in. insulation and 9/64-in. lead sheath, and 1,750,000-circ.mil, 12-kv. cable used as leads to the transformers feeding the 66-kv. lines and having a 1-in. rope core, 5/16-in. insulation and 8/64-in. lead sheath. For these cables as installed in adjacent ducts on 6-in. centers the sheath losses are, respectively, 85 and 220 per cent of the copper losses. With no sheath losses the unneutralized induced sheath voltages are approximately 2.3 volts per 100 ft. at the winter rating of 60,000 kva. for 66-kv. cable and 4.3 volts per 100 ft. at winter rating of 20,000 kv. for 12-kv. cable.

Any insulating joint used to interrupt the electrical continuity of the sheath circuit should be mechanically rugged, impervious to moisture, fluid-tight under all operating conditions of internal pressure and vacuum and should have an insulating ring or surface of sufficient length to prevent excessive current leakage across the insulator. It must operate satisfactorily when totally submerged in manhole water for years at a time. A number of insulating sleeves have been devised. No leaks or deterioration have occurred through the insulating medium of the few thousand of one type used by the Commonwealth Edison Company for one-half to 2½ years.

Approximately 130 miles of single-conductor cable on the system of the Commonwealth Edison Company has been specially bonded to eliminate sheath losses beginning in the fall of 1926. Over 90 per cent of the sheaths have been bonded as indicated in method "A," Fig. 3. The resultant voltage to send current through the sheaths is quite small because the voltage induced, for instance, in the sheath of phase "C" in section 1 is added vectorially to the induced voltages in the sheaths of phase "B" in section 2 and of phase "A" in section 3. Due to unequal voltages, the sheath losses may be 1 or 2 per cent of the conductor losses.

From the standpoint of possible corrosion of the sheath due to the a.c. voltages present, the maximum safe voltage on the sheath, according to the experience of the Commonwealth Edison Company, is about 12 volts between sheath and ground for Chicago conditions. For the 66-kv. cable this voltage is reached with lengths of about 500 ft. between insulating joints. If longer sections are desired in order to reduce the cost of manholes and joints, then methods "B" or "C," Fig. 3, can be used. In method "B" the voltage to ground is reduced to 50 per cent as compared to method "A," while the reduction for "C" is 40 per cent. The company has found that by using method "C," the maximum length of sections of cable could be increased to approximately 660 ft., the length of a standard city block, at an additional cost for the bonding devices equal to a small fraction of the saving in manhole and installation costs. The practice of the company has been to use the three-phase sheath bonding transformer, which, for method "B," with a rating of 11 volts between phase and neutral, is approximately 9 x 13 x 17 in. across the outside of the case. In addition to the primary coils shown in Figure 3, the transformer has short-circuited secondaries, through which, during normal operation, no current flows; however, during failure the device acts as a single-phase transformer with the secondary short-circuited and presents a minimum impedance to the flow of the fault current.

In connection with minimizing the possible corrosion due to a.c. sheath voltages, the uniform surface of fireproofing material has been applied by using the asbestos tape next to the sheath as indicated in Fig. 8 (see page 1098, Electrical World, June 1, 1929). Tests have shown also that cement fireproofing is satisfactory from the standpoint of a.c. electrolysis.

Cost of Pole-Top Switch Installed

OPERATING a wide-flung system on which overhead line costs are a major part of the total system expense, one Middle Western utility has furnished to its divisional managers and other local employees a series of cost and material sheets by which they may roughly check line extension costs. Included in these sheets is one covering the installation of a 33-kv. air-break pole-top switch, data from which are presented here.

Installation Cost Data

33-Kva. Air-Break Pole-Top Switch

Material	Size	Quantity	Unit Price	Item Cost
Three-pole air-break switch	600 A	1	$255.00 each	$256.00
Operating rod insulators	No. Y7660	1	6.50 each	6.50
Pole	40 ft.	1	16.95 each	16.95
Strain insulators, two per string, complete with hardware	No. A257	6 str.	5.40 each	32.40
Total material				$311.85
Stores department—10 per cent				31.19
Labor				42.00
Transportation and supplies				24.00
Total—Material and labor				$409.04
General office supervision				40.90
Total cost				$449.94

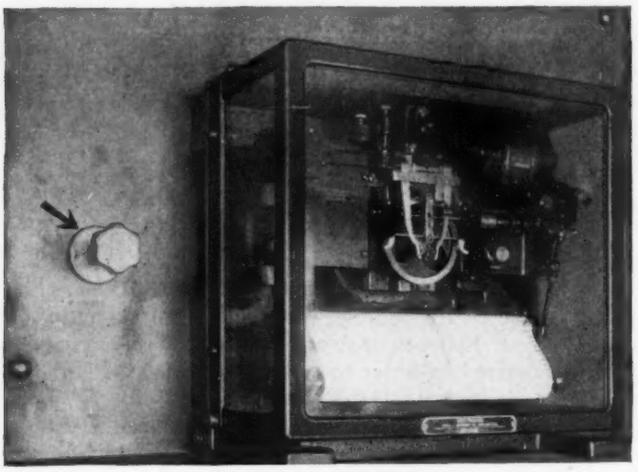


Fig. 1—Frequency Recorder and Positions of Special Contact and Switch Handle

Automatic Freq

By J. U. BENZIGER*
and J. T. JOHNSON, JR.†

AS INTERCONNECTIONS between large power systems become more common the demand for holding system frequency variations within very small limits becomes increasingly important. Proper regulation of interchange of power from one system to another is dependent on positive control of system frequency at all times. On the Alabama Power Company's system and on interconnected Southeastern systems certain textile as well as paper and fiber manufacturing processes require close frequency regulation in order to control successfully the manufacture of the finished product. Only a small variation in frequency is often sufficient to ruin the product while in process of completion.

With one generating plant regulating frequency and all other plants on base load it is impossible to maintain very close frequency regulation with hand control. Under the most ideal conditions hand control by station operators results in irregular system frequency variations. Especially is this true during stormy weather or during emergencies when station operators must need devote the greater part of their time and attention to switching operations and to the maintenance of service.

The Alabama Power Company's system being a widely distributed system and being fed principally from hydroelectric generating plants, it is not possible to obtain extremely close frequency regulation such as is obtained on a concentrated metropolitan network fed from steam-generating plants. However, a rather simple scheme giving close frequency regulation has been in service at Mitchell Dam for several years and will no doubt be used at other plants on the Southeastern system.

The frequency control scheme as developed at Mitchell Dam may be used for automatic control of any one generator or simultaneous control of all three 20,000-kva. generators. The automatic features in no way interfere with hand control of the machines, since a special drum type control switch on each generator panel provides for connecting the water-wheel governor motor either for hand control or automatic control. A white pilot lamp on the generator switchboard panel burns when the machine is on automatic control, thus giving the operator positive indication at all times.

The scheme at Mitchell Dam makes use of the standard Leeds & Northrup frequency recorder, to which was added one small light-weight contact. In addition two type HG auxiliary relays, control switches and pilot lamps are required. Behind the switchboard a "raise"

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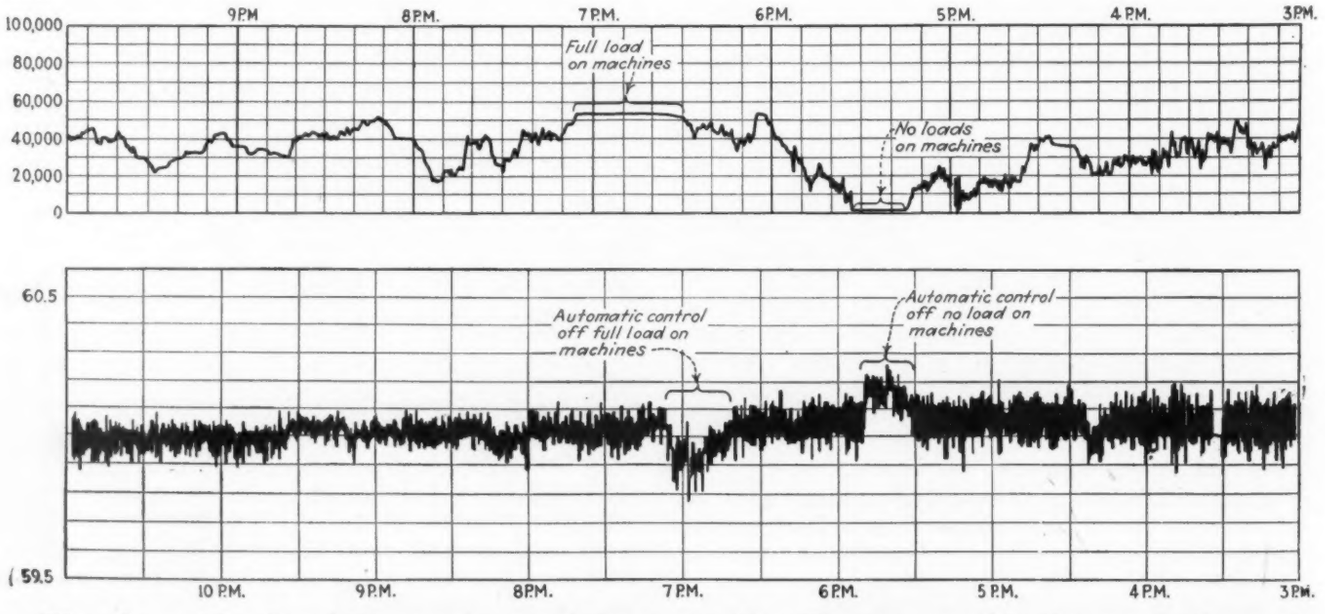
†Operating Department, Alabama Power Company.



Figs. 2a and b—Load Fluctuations and Corresponding Frequency with Automatic Control

quency Control

at Mitchell Dam

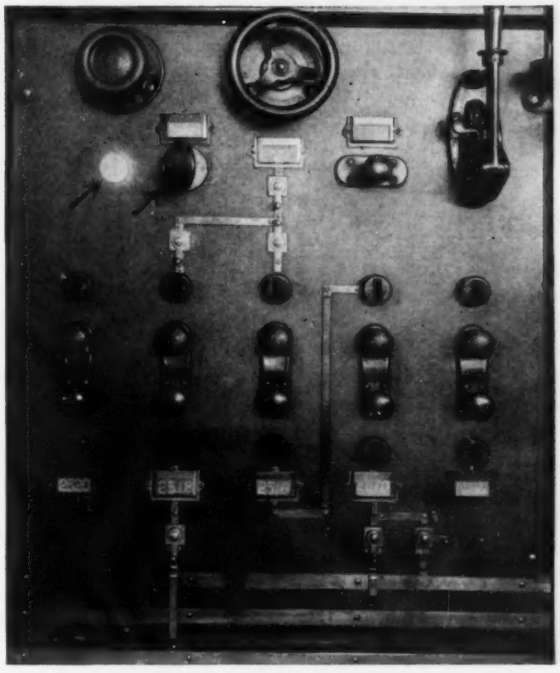


Fig. 4—Generator Panel with Drum Control and Pilot Light

and "lower" bus has been added to the existing control buses in order to permit the desired control features.

In front of the recorder on the Mitchell Dam switchboard is a light-weight telephone type contact actuated by each revolution of the front cam of the recorder mechanism. There is also mounted on the same panel and to the left of the recorder a switchboard type double-pole single-throw switch. This serves as a 140-volt d.c. supply switch for the entire automatic frequency control scheme. When the control switch on the generator panel is in the "in" position the governor motor is on hand control and the speed of the machine may be raised or lowered in the usual manner by turning the control switch to the left or right. In the "out" position the hand control connections are broken and the machine is on automatic control. With the drum control switch in the "out" position a set of contacts are closed to burn the white pilot lamp and thus indicate to the operator that the particular machine is on automatic control. One, two or all three machines may be put on automatic control by operation of the drum type control switch mounted on each generator panel. This scheme might be expanded so as to be applicable to any number of machines in one generating plant.

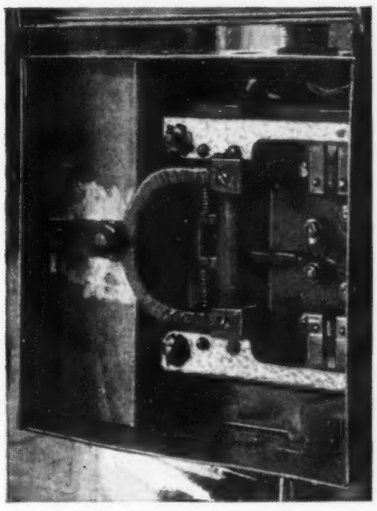


Fig. 3—Travel Limit Switches Connected to Governors

In order to prevent overtravel of the waterwheel governor while regulating with the recorder contact *B* (Figs. 1 and 5) is provided to give short regulating impulses to the governor motor. This contact may be adjusted to maintain the frequency within any desired limits. Two type HG 140-volt d.c. auxiliary relays connected as shown on the schematic diagram are used to energize the "raise" or "lower" bus. If the frequency is exactly 60 cycles contact *A* assumes the mid-position and contact is not made to either side even though contact (Fig. 5) *B* is closed at regular intervals by the cam mechanism of the recorder. However, with a frequency variation of 0.1 fast or slow, *A* is closed to the right or left to close the corresponding *HG* relay and give a momentary impulse to the "lower" or "raise" control bus each time *B* makes its regular contact.

Automatic frequency control is not desirable when a machine is operating at no-load or at full load. In order to take care of such load conditions governor travel limit switches are installed on the waterwheel governor to open the "raise" or "lower" governor motor control circuit when the governor reaches a predetermined position of

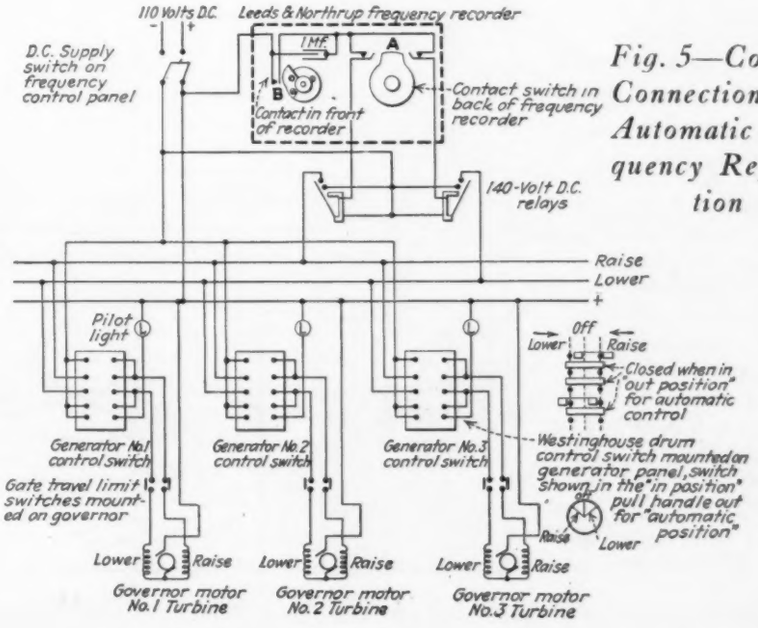


Fig. 5—Control Connections for Automatic Frequency Regulation

full load or no load. A typical frequency chart obtained with automatic frequency control of three machines is shown. This chart clearly indicates the action of the governor travel limit switches when machines are operating at no load and at full load.

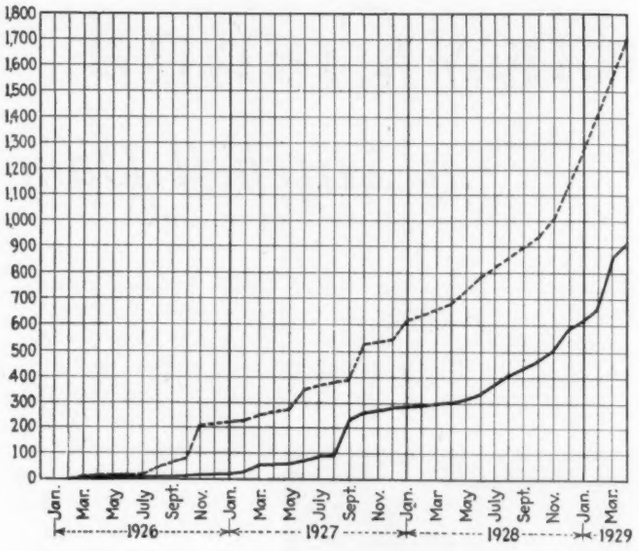
Strength of Structural Welds

RESULTS of 173 tests of metal arc welds are now available, indicating the uniformity of strength and reliability of the welds, according to Andrew Vogel, General Electric Company, who presented a paper on "Design of Joints for Welded Steel Structures" before the American Welding Society recently. It will be observed from the accompanying curves which he presented that all $\frac{1}{4}$-in. welds failed at a stress of 10,500 lb. per linear inch or more; all $\frac{5}{16}$-in. welds failed at a stress of 11,500 lb. per linear inch or more, and all of the $\frac{3}{8}$-in. welds failed at a stress of 12,500 lb. per linear inch or more.

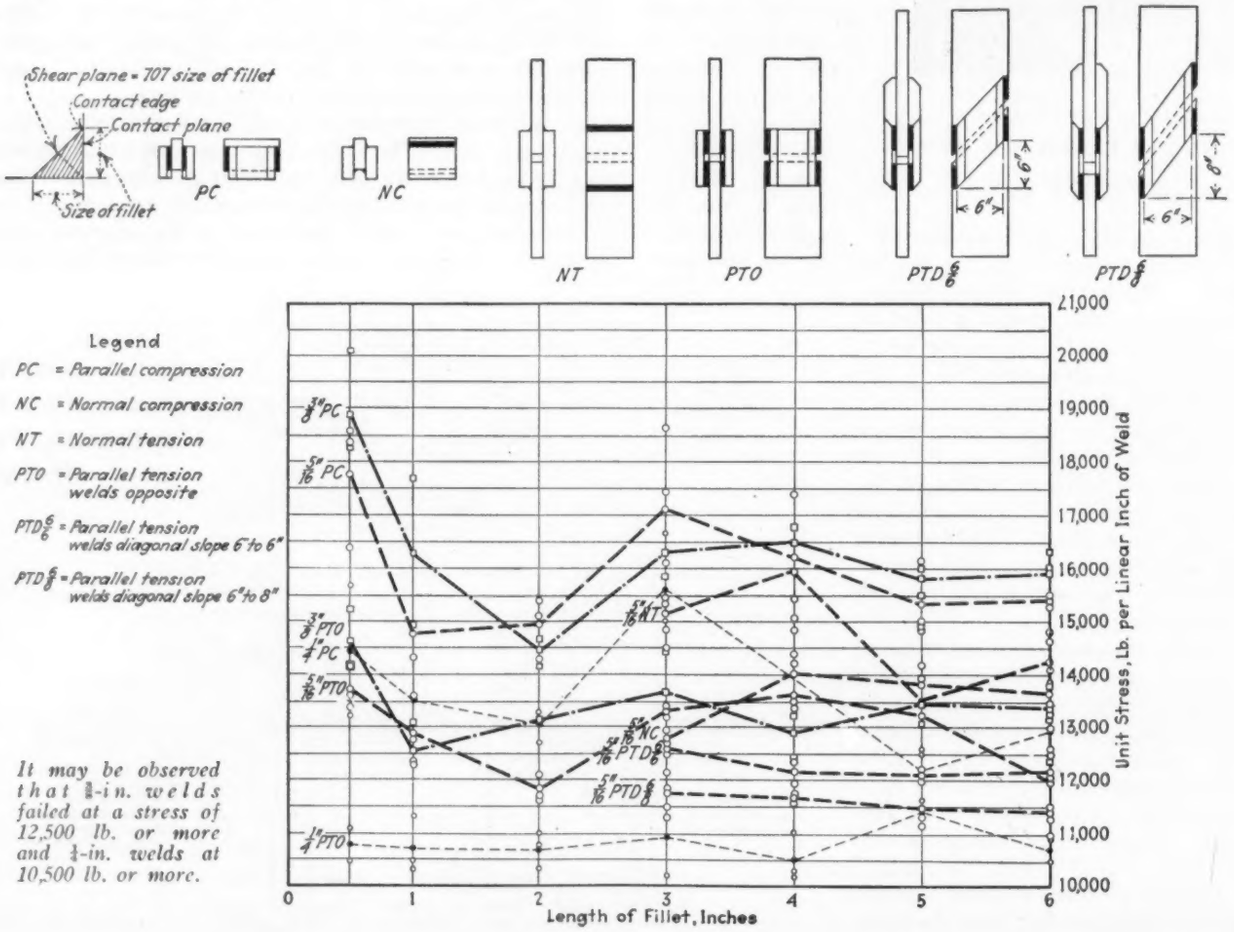
From these tests it was concluded that the proper design value to use was 2,000 lb. per linear inch for $\frac{1}{4}$-in. welds; 2,500 lb. per linear inch for $\frac{5}{16}$-in. welds and 3,000 lb. per linear inch for $\frac{3}{8}$-in. welds. These values result in a factor of safety of four or more in all cases for which data have been gathered.

Observation of the design of test specimens will indicate that the various types of welds which will be encountered in design are represented, and also that the bars of the test specimens were sufficiently large so that the stresses in the bars were well within the elastic limit at the time the welds failed.

"Red Seal" in Chicago



EVIDENCE that selling adequate wiring by pushing the "red seal" plan is like starting a snowball down hill is presented by the accompanying graph. The curves show cumulative totals of "red seal" applications (dotted line) and certificates (solid line) issued in Chicago and its suburbs in three and one-third years. According to the Electric Association of Chicago, which is the source of the data in the graph, the rapid rises in 1928 and 1929 are the results of getting "red seal" across to architects and contractors.



It may be observed that $\frac{3}{8}$-in. welds failed at a stress of 12,500 lb. or more and $\frac{1}{4}$-in. welds at 10,500 lb. or more.

Reproduction Cost Alone Inadequate Value Basis

Byllesby vice-president shows Wisconsin Legislature committee on water power it is only one factor in complex situation

THE error of resorting entirely to reproduction cost new in utility valuation was brought out by William J. Hagenah, vice-president and special counsel of the Byllesby Engineering & Management Corporation in his recent appearance before the Wisconsin legislative interim committee on water powers. The facts presented show the paramount bearing which the trend of prices has on this basis of valuation.

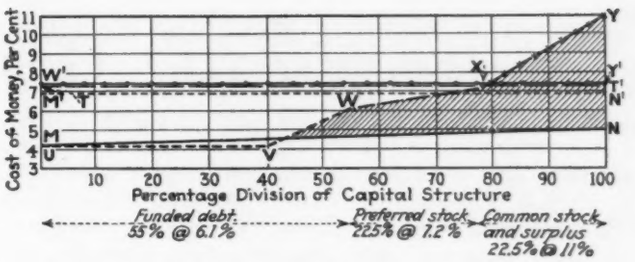
The Supreme Court of Wisconsin, according to Mr. Hagenah, had recognized the error of depending entirely on reproduction cost as far back as 1896. Subsequent to 1915, as the accompanying chart indicates, commodity prices and operating costs advanced rapidly, while the purchasing power of income from operation declined. As the utilities appealed for relief at that time to escape from receiverships, they presented appraisals showing the reproduction cost of their own properties on the new price levels that were being used in ascertaining values and earning power in other fields. Mr. Hagenah points out that there was no intention that these should be used exclusively as a determinant of value.

It will be seen from the chart that the spread between reproduction cost new of electric utility properties and their actual cost is negligible, but this has not been the case in the past, nor is it likely to be in the future. The construction index curve is tending downward at the present time, while the index of weighted average actual cost to date is rising sharply. If present conditions continue, says Mr. Hagenah, it will not be many years before the lines crossed. What will then be regarded as the proper basis of valuation? It is brought out by the chart that while of great value as a factor in determining costs the exclusive use of the reproduction cost basis is entirely inadequate.

Turning to the relative cost of capital to private and municipal plants, Mr. Hagenah shows that the counsel for the League of Municipalities has argued that because private plants require earnings of 7.50 per cent on the fair value of their property, while municipal bonds sell to yield from 4.25 per cent to 5 per cent, the cost of capital for a state or municipal acquisition and development of electric utilities is much cheaper. It is pointed out, however, that in this reasoning the fundamental difference in the character of the two classes of financing is overlooked. It is shown that the loss in taxes under municipal ownership offsets the savings which result from higher public credit. The difference between the two types of financing is clearly shown in the accompanying illustration; the shaded portion represents the added cost of raising money by privately owned utilities through the sale of preferred and common stock after a conservative limit has been reached in bond financing. Municipally owned plants have the advantage of being able to finance entirely by the sale of bonds secured by the credit of the entire community. Privately owned utilities are obliged to pledge their entire plant in order to raise only a portion of their capital at the low cost comparable with public financing. After the sale of bonds the diminished margin of security is compensated for by the higher rates of return on stock issues.

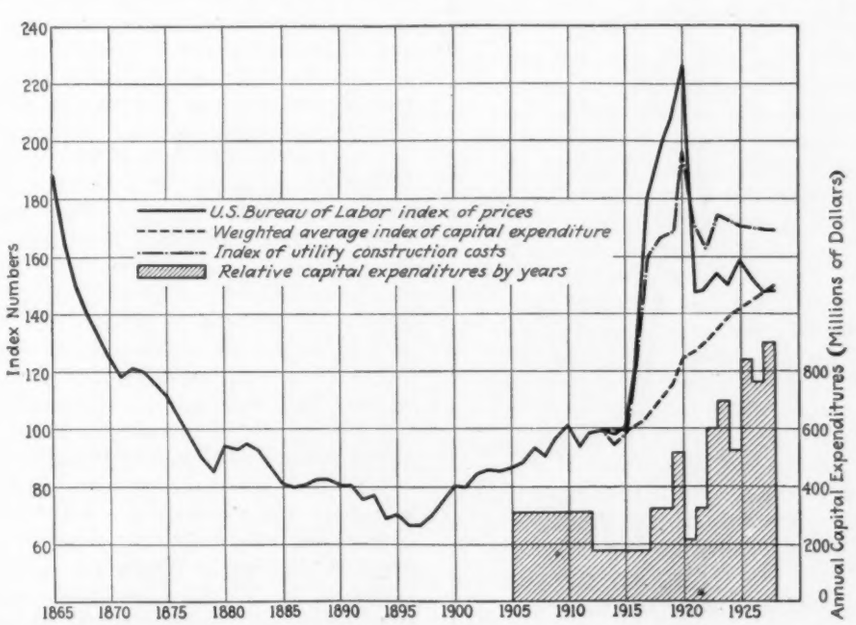
While private industry adapts itself in a direct manner to the higher cost of money, municipalities do the same thing in an indirect manner. This becomes apparent when we add to the municipal rate of financing the loss in taxes resulting from taking over privately owned plants.

The advantage that is claimed from municipal financing then entirely disappears, according to the writer.


Cost of Money, Per Cent
Percentage Division of Capital Structure
Funded debt 55% @ 6.1%
Preferred stock 22.5% @ 7.2%
Common stock and surplus 22.5% @ 11%

Comparative Cost of Money to Privately Owned Utilities and Municipalities

Line *MN* equals cost of money to municipalities as shown by range in yield of municipal bonds ..... 4.10 to 5 per cent
Line *UVWXY* equals cost of money raised by utilities through sale of bonds, preferred stock and common stock. 4.10 to 11 per cent
Line *U'Y'* equals weighted average cost of money to utilities ..... 7.45 per cent
Line *M'N'* equals total cost to taxpayers when there is added to the cost of municipal financing the loss in taxes now paid by private plants ..... 6.85 per cent
Line *TT'* equals total cost to taxpayers when effect is also given to loss in federal income taxes from the tax exemption of municipal bonds substituted for utility securities..... 7.35 per cent


U.S. Bureau of Labor index of prices
Weighted average index of capital expenditure
Index of utility construction costs
Relative capital expenditures by years
Index Numbers
Annual Capital Expenditures (Millions of Dollars)

Relation Between Reproduction Cost and Actual Cost

Industrial Heating Revenue Exceeds $900,000 per Year

ANNUAL revenue from the sale of energy for industrial electric heating on the system of the Connecticut Light & Power Company will exceed $1,000,000 by 1930, it is anticipated. Ninety per cent of this figure has now been attained. Robert M. Keeney, industrial heating engineer of this company, states that the connected electric furnace load of this company increased from 1,775 kw. in 1918 to 22,798 kw. at the end of 1928, the estimated energy consumption having grown from 8,000,000 to 63,695,000 kw.-hr. Last year the company added 3,049 kw. of total industrial electric heating equipment with an estimated increased revenue of $109,860 and 8,489,000 kw.-hr. added energy consumption (at an average of 1.29 cents per kilowatt-hour). Thus, last year's accretion exceeded the total connected electric furnace load of ten years ago.

This year, to May 1, 1,590 kw. of industrial electric heating equipment has been added, with an estimated annual consumption of 4,157,000 kw.-hr. and $55,520 increased revenue (about $35 per kilowatt).

In considering the tabulated growth of this business it should be noted that the yearly consumption and connected load do not go hand in hand, due to the fact that some customers operate their own plants and thus supply a portion of the heating load themselves. The connected load figures are the total connected load in heating service in such plants, but the yearly consumptions are based on actual sales for industrial heating operations. There is also a lag each year between connected load and sales, for the reason that no estimated sales are included in the total until equipment is placed in operation, whereas the furnace is listed as connected load as soon as the industrial plant makes a purchase from the furnace builder. The reduction in energy sales during 1926 was due to increased loading of a large customer's own plant with this class of business, although there was a marked increase in new equipment added to the Connecticut Light & Power system.

Electric Furnace Load Gains 1,180 per Cent in a Decade on One System

Year	Connected Load, Kw.	Yearly Sales, Kw.-Hr.
1918	1,775	8,000,000
1922	4,000	18,000,000
1923	7,000	28,000,000
1924	9,820	36,240,000
1925	14,008	48,563,000
1926	17,616	*44,969,000
1927	19,807	56,213,000
1928	22,798	63,695,000

*One customer increased generation in own plant, causing decrease in energy sold in 1926.

Revocable Permit Encourages Development

"NEARLY 100 cities and towns in the state of Oklahoma have secured electric service, and approximately the same number gas service, which had no such service prior to the meeting of the 1925 Legislature and the passage of the revocable permit bill. Many more cities and towns previously only having part-time electric service have secured 24-hour service under the operation of this law. Electric transmission line mileage in Oklahoma has increased more than 150 per cent with this law in operation and gas pipe line mileage exceeding 4 in. in size has increased more than 1,500 miles. Forty million dollars of new capital has been attracted to Oklahoma, new financing being facilitated by the fact that no longer does expiration of their right to operate in certain towns before maturity of the securities offered confront companies seeking to raise funds for expansion."

E. F. McKAY.
Manager Oklahoma Association.

Saving the Eyes with Better Lighting

BY M. LUCKIESH
National Lamp Works of General Electric Company, Nela Park, Cleveland

WHERE eyesight conservation of adults in the work-world, of children in schools and of every one in the home has been properly stressed it awakens a lighting consciousness. But it is surprising that most persons are not conscious of the great possibilities and needs of better artificial lighting.

The following table summarizes the results of the examination of individuals in all parts of the country, comprising large numbers of school children, advanced students in normal schools and colleges and persons employed in industrial and commercial establishments:

	Number Examined	Number Defective	Per Cent Defective
20 cities, schools	483,154	105,799	21.9
32 normal schools, colleges, universities	46,751	18,706	40.0
37 commercial and industrial concerns	204,817	90,739	44.3

These examinations not only show a high frequency of uncorrected and corrected eye defects but indicate, as well, that these troubles increase in frequency with age. Evidence is not wanting to show that the situation at large is growing worse from year to year and that the present increasing demands upon the eyes do not merely expose the trouble, but are a cause of it as well.

The obvious remedy is to relieve the eye strain. Much is being done in the office and the workshop to improve lighting, but the damage is done during the early years of life, when the human organism is still flexible, but is nevertheless permanently affected by the conditions which surround it. The work of the schoolchild is done largely by daylight in schools and by artificial lighting at home. Not all of the seats in the schoolroom can be located next the windows and daylight is short in the winter and uncertain at all times, therefore artificial lighting is needed to safeguard vision.

The adequate artificial lighting of our homes and our college dormitories would help. The provision of installations in the classrooms of our schools, colleges and universities would furnish a means of bridging the deficiencies of indoor daylight. Such lighting should be sufficient for all purposes in the total absence of daylight, and, once installed, would be used under conditions which would not initially make it imperative.

Neon Tubes Warn of Hazards

in New York Substations

By E. W. Gorry

Superintendent Substations, The United Electric Light & Power Company, New York

Permanently installed tubes avoid objections of portable units. Supplement pilot lamps or used where latter cannot be applied. Principles observed in application

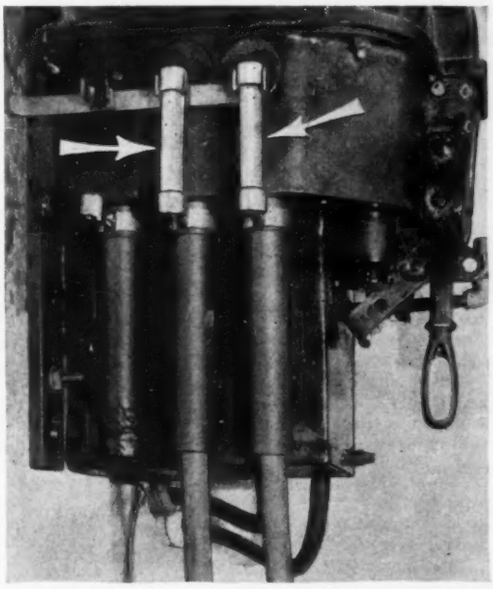
IT HAS been apparent for a long time that a modified form of Geissler tube might be useful in providing a visual indication of energized high-voltage conductors. Experiments made with the tubes designed for testing automobile ignition circuits showed that their performance was entirely too unreliable for their use around high-voltage light and power circuits. The uncertainty of the action was due to such variable factors as the position of the tube relative to the axis of the conductor to be tested, conductivity of the supporting medium and potential gradient in the vicinity of the conductor.

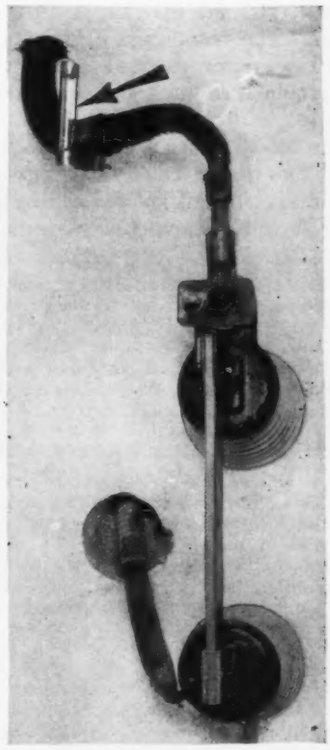
Some tests made with one of these tubes fastened to the end of a wooden switch stick showed that its indication might even be dangerously misleading. For example, an indicating tube held between two parallel conductors connected to the same phase of a three-phase system gave no indication that the conductors were energized because both ends of the indicating tube were in electrostatic fields of the same intensity and polarity.

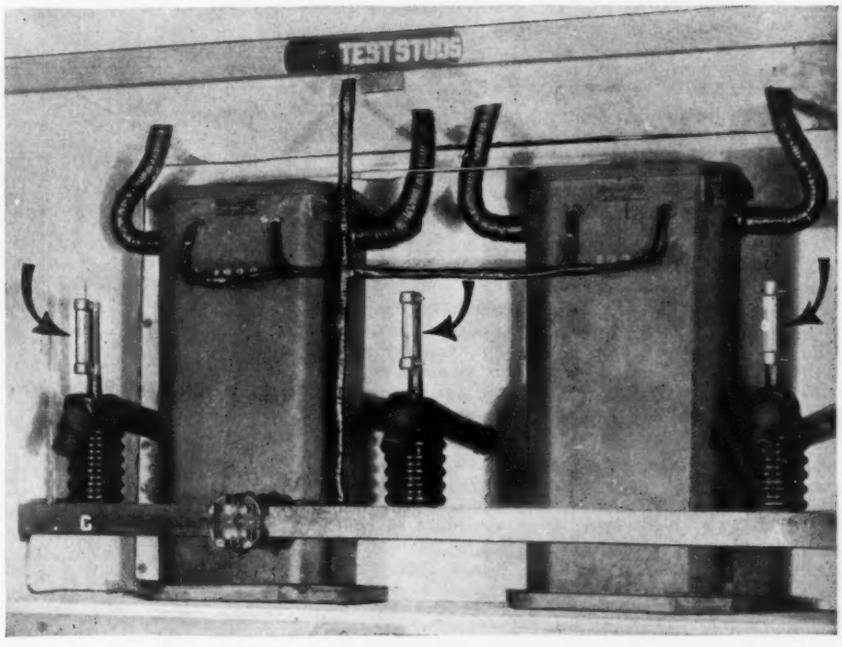
However, the cheapness and simplicity of these tubes justified the effort of devising ways in which they could be employed as non-portable devices so as to obtain a high degree of reliability. The following principles were considered fundamental:

1. The tubes will be used only in locations where an indication is desired to *supplement* that afforded by the usual pilot lamps operated from potential transformers or where such pilot lamps cannot be applied.

2. The indication of the tube is not to be depended upon in lieu of positive tests and protective measures prescribed by existing operating rules and regulations. No employee is permitted to work on a high-voltage conductor if it is merely tested and shown to be dead at the time work is commenced. Any conductor that is to be worked upon must be adequately isolated or grounded on both sides of the point at which work is done.







Three Applications of Neon Tubes as Warning Indicators of Energized Conductors

3. Where neon indicating tubes are installed, they must be arranged so that at least two tubes are coupled with the same conductor or to different conductors of the same feeder and are visible at the same time. This provision is an adequate safeguard against tube failures.

4. The tubes must be sensitive enough to give a reasonably intense light without the use of coupling condensers other than those formed by the tube terminals and metal mounting clamps.

5. The tubes must all be subjected to acceptance tests after delivery by the manufacturer.

After some experiments a satisfactory type of neon tube was developed that could readily be applied in the locations at which voltage indication was desired. This tube is in the form of two concentric cylindrical glass tubes. The inner tube carries two sealed-in electrodes with pointed tips about an inch apart. This tube contains the neon gas. For mechanical protection a close fitting outer tube of glass is provided to which brass ferrule terminals are cemented. The lead-in wires are soldered to these terminals. The completed tube resembles a ferrule-type cartridge fuse.

The most important applications of neon tubes as voltage indicating devices on the United Electric Light & Power Company's system are as follows:

1. *In High-Voltage Reactor Compartments.*—These compartments require relatively frequent cleaning. While feeders are always taken out of service and grounded for such cleaning, there is a possibility that doors will be removed from a live compartment by mistake. Each compartment is provided with two neon tubes mounted a few inches apart and in a conspicuous position. The tubes are heid in clamps fastened directly to the concrete cell walls. The free end of each tube is directed toward the reactor, maintaining a minimum air clearance of 4 in. to any part of the reactor. A very satisfactory indication is obtained.

2. *Where Test Connections Must be Attached to High-Tension Feeders.*—Tests for cable identification, continuity and for fault location require that connection to the feeder conductor be made in a safe manner. To avoid fully withdrawing truck switches and entering switch compartments permanent test terminals have been provided. In the case illustrated these are mounted in the potential transformer compartment of the outgoing feeder to which they are connected. When the feeder is in service the live metal parts of the terminals are covered with protective insulating caps which are threaded and screwed on the test studs. The studs are threaded to fit a swivel type of insulated terminal which is provided on the ends of all portable leads used for feeder testing. The insulator of each test stud supports a vertical "Micarta" rod to which a neon tube is clamped. The tube is not electrically connected to ground or to the live stud, but operates through electrostatic coupling with the live conductor and the test stud.

The feeder must be dead and grounded while test leads are being attached to or removed from the feeder test studs. Grounding is accomplished by means of interlocked bayonet rods. The neon tube indication is considered supplementary to that obtained from the feeder pilot lamp on the switchboard and is observed in *addition* to other checks prescribed by operating rules before feeder grounds are applied. The tubes also serve as a warning in the event that the doors of a live compartment are open.

3. *On Supply Side of 3,000-Volt Oil Switches on Distribution Transformers.*—Each tube is attached by brass clamps to the insulating bushing through which the single-conductor supply cables pass. The opposite end of each tube is grounded in order to improve the indication with the relatively low operating voltage (1,732 volts to ground) and the small electrostatic capacity of the supporting clamp which serves as a condenser plate. The tubes used on primary switches afford a cheap and very satisfactory pilot device whose indication saves valuable time in inspecting primary supply points during distribution circuit trouble.

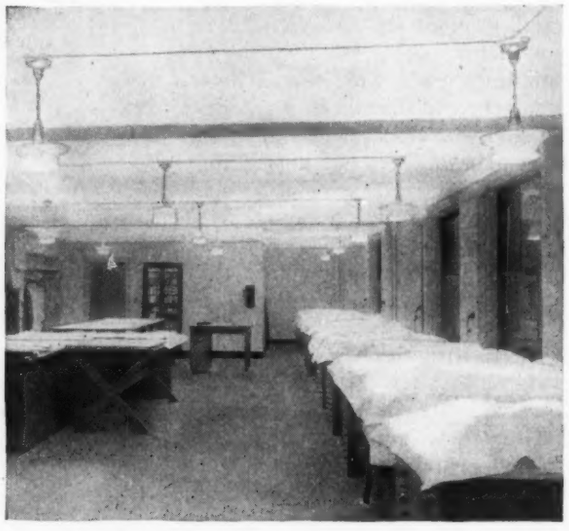
4. *On High-Voltage Feeders to "Loop" Customers.*—One tube is applied to each conductor of each feeder within the stationary cubicle of the truck switch. One end of each tube is grounded. The other end is insulated from ground and connected to an electrode which enters a cavity molded in the porcelain supporting insulator of the feeder disconnecting contact of the truck switch. Sufficient coupling is obtained to give a very satisfactory pilot indication on 7,800-volt and 13,200-volt feeders. The neon tubes are visible from the exterior of the truck switch through shatter-proof glass bull's-eyes about an inch in diameter. The use of potential transformers for pilot lamp operation could not be justified on account of the space required and the cost. The neon tube indication is valuable in determining which of two feeders is alive and available for use in the event of service interruption. Employees are required to observe the indication of all three tubes on each feeder in addition to checking the opening of switches at all ends of a feeder about to be grounded.

In the substations and high-tension customer installations of the company there are about 500 tubes in service. Among these there have been no recorded tube failures from deterioration in a period of five years. There are a few tubes which have become nearly opaque in spots owing to the deposit of some substance on the inner walls. There are more than 1,000 tubes in service on 3,000-volt primary switches. Among these there have been replacements, principally because of breakage. There have been some failures of indication where the seals of electrodes have apparently leaked and disturbed the gas conditions within the neon tube proper.

Architect Uses 14 Foot-Candles on Drafting Tables

By W. F. Rooney
Illuminating Engineer
Edison Electric Illuminating Company of Boston

ONE of the best lighting installations in Boston architectural office circles is that of Bigelow, Wadsworth, Hubbard & Smith, where the drafting room occupies an irregular T-shaped area of about 1,100 sq.ft., contains 24 tables and benches and utilizes an average intensity of 14 foot-candles on the working plane with a connected lighting load of 2,800 watts. Fourteen 200-watt clear lamps in "Duplexalite" fixtures spaced 10 ft. apart longitudinally and 7 ft. 6 in. apart laterally are installed in three rows of six, five and three units each with a mounting height of 7 ft. 6 in. above the floor and a suspension 18 in. below the ceiling. The original intensity secured was 18 foot-candles, but since a soundproof ceiling was recently installed and finished with "Sunflex" paint the reflection factor was reduced. The lessening of the intensity has not impaired the quality of the illumination.



Night View of Architects Office with 14 Foot-Candles on Working Plane

Quality Standards

The limitations of present approval systems and a way of encouraging production and sales of high-grade equipment. Enables purchaser to judge relative values. Manufacturer profits in proportion to merits of products

By PRESTON S. MILLAR
General Manager Electrical Testing Laboratories

SAFETY, effectiveness, convenience, and reasonable durability are essential requirements of any electrical equipment used by the public. Every reasonable effort to incorporate safety may claim the wholehearted support of the entire electrical industry. However, when effectiveness, convenience and durability are concerned no one standard can properly represent the variable requirements.

In residences of well-to-do people, whose resources command the best in the way of service, the standard of effectiveness, convenience, durability and also of appearance is required to be very high. On the other hand, in the summer bungalow or the mechanic's cottage, some sacrifice of effectiveness, convenience, durability and of appearance as well may be justified if lower costs result. To attempt to set one standard in these particulars violates the requirements of reasonableness and places standardization, for the sake of standardization, above service to the public.

A variety of quality standards and systems of approval has been initiated and administered by interests outside the industry. They claim the attention of buyers and users who are importuned to look for various labels signifying approval. Some of these approvals are based upon organized testing procedure, but the bases for others are not apparent. As a result electrical equipment having a low order of effectiveness often bears approving labels, whereas equipment deserving meritorious labels bears none. Whatever merit may inhere in approval systems based upon fixed standards has been pretty largely dissipated through the activities of non-electrical interests which for their own purposes have adopted such methods in dealing with electrical equipment.

UNDERWRITERS' LABORATORIES

Underwriters' Laboratories, within the limits of the situation in which it is placed, is believed to be doing a competent and sincere work in testing and judging electrical equipment. But Underwriters' Laboratories, in the very nature of the case, is concerned almost exclusively with safety. Its operations presumably cover all essential qualities only when dealing with equipment intended for safeguarding service. Its concern in other cases ceases when it is convinced that electrical equipment does not involve hazard. There is reason to believe that the listing, sound though it may be from the point of view of freedom from hazard, is sometimes misinterpreted to mean more than is intended. One hears much of "sub-standard" material and equipment. When the basis of this is lack of Underwriters' Laboratories' listing, it may be taken to mean that the equipment is unsafe and as such should not be employed. But much equipment employed in electrical installations is not listed by Underwriters' Laboratories, not because it is unsafe, but because for one reason or another the material has not been passed upon by the Underwriters' Laboratories.

On the other hand, equipment and material which the Underwriters' Laboratories lists connoting safety sometimes is ineffective and unworthy of use in electric service. This is not the fault of the Underwriters' Laboratories, but is the inevitable consequence of the concern of insurance interests for safety only and of the indefiniteness of the requirement that electrical equipment shall be passed upon by Underwriters' Laboratories.

THE FUNDAMENTAL REQUIREMENT

To be ultimately effective, a system of quality control for electrical equipment must take into account such factors as effectiveness, convenience, durability and, in some cases, appearance, as well as safety, and must cover all brands and types of equipment. It must have the support and backing of all essential elements of the electrical industry; they must be convinced that it is for the best interests of the industry and determined to make it effective. The control system must be based upon all qualities and performance characteristics which determine merit.

Intelligent procedure is not possible until there is full understanding and agreement regarding the conditions and performance characteristics required for satisfactory service and the relative importance of each. The essential elements of the electrical industry should reach such an understanding in order that the efforts of all may be directed toward achievement of these desirable qualities in the highest practicable measure.

Another essential is the determination of the relative qualities of the various brands of equipment. When this is accomplished it becomes possible to arrange brands according to their order of merit, as follows:

Electric - - - - - - s

(Brands disapproved from the safety point of view are excluded)

Brand	Effectiveness, Convenience, Durability, etc.
Ideal	100 per cent
X	90 per cent
Y	60 per cent
Z	30 per cent

The purchaser may be further guided by various considerations, which may be summed up in the phrase

"Sales Appeal." Assuming that in appearance and suitability an appliance is entirely satisfactory, the purchaser of means who desires the appliance for a permanent service in a well-ordered home presumably will select the appliance which is of highest merit if that information is available. In our suppositional case he would select brand X, for which presumably he would be called upon to pay a relatively high price. On the other hand, the purchaser of limited means, or one who seeks the equipment for occasional use, would, presumably, select some less expensive brand provided only that it is reasonably effective for its purpose. He might choose brand Y. Brand Z, no matter how low its price, is presumably too ineffective and unsatisfactory to warrant purchase and for the good of the electrical industry and the public ought not to be sold. It would not be sold if its qualities were known and understood.

It is the inescapable weakness of a fixed quality standard and an approval system based thereon that the requirements of the industry and the public are not served satisfactorily. Such a standard as a practical commercial matter cannot be fixed at the top of the quality range, or, say in our suppositional case, at 90 per cent. It must be low enough to take in several of the better brands of appliances. It might perhaps be fixed at 70 per cent. The manufacturer of the 70 per cent appliance is then well pleased. He secures the indorsement of the approving authority, and in proportion as this is of influence his business is aided. In that case the manufacturer of the superior 90 per cent appliance receives no assistance from the approval system in his competition with the manufacturer of the 70 per cent appliance. On the contrary, his efforts are rendered more difficult because the approval appears to certify that the 70 per cent appliance is satisfactory and additional expenditure for the 90 per cent equipment may generally be regarded as unjustifiable. A premium is placed upon mediocrity. The tendency is to level all to the grade that will just barely escape disapproval.

If, on the other hand, the qualities of electrical appliances are ascertained and made known, each product will receive such credit as it deserves, superiority will be rewarded and inferiority will bring its own condemnation. Each purchaser, and perhaps the electrical industry as a whole, may decide what minimum grade is considered to serve the purposes in mind and thus a minimum standard of quality for a given service may be set. Nothing below such minimum grade will be considered, while appliances of higher grade will receive credit for their superiority. The effect of such a grading system, in proportion to its influence, will be to raise the level of appliances to that of minimum grade accepted for any service and to allow ample opportunity for superiority above that grade to bring its own reward of higher price for preferred service.

The Need for Facts

Fundamental to progress in the improvement of customers' electrical equipment is the requirement for facts of quality and performance. Much of the difficulty now being experienced in equipment which the public employs is attributable to dearth of knowledge concerning such facts. The information, to be effective, must be obtained in a generally acceptable, unbiased, authoritative manner which will command the confidence of all concerned and must be made available under auspices which will exclude prejudice and insure fair dealing. In proportion as the facts of quality and performance can be made available the situation, to use a homely but effective word, will be "debunked." Manufacturers will be stimulated to their best efforts in production of really good electrical equipment and merchants will be in a position to select and offer to the public equipment which will give satisfaction. In each class of service superior equipment whose merits are thus demonstrated will command a higher price, mediocre equipment will tend to sell for a fair price, and it will become more and more difficult to sell inferior equipment.

The Manufacturing Situation

The electrical industry in America is fortunate in being served by a number of manufacturers of unquestioned competency who seek to build their future on a reputation for good quality products. These manufacturers place upon the market equipment which, in general, is of higher grades and of a good degree of reliability. Their efforts in these directions will be stimulated and made more effective if the facts of quality and performance of their products are ascertained independently and made available for the guidance of purchasers. In a wide experience of testing I have never yet found a manufacturer, no matter what his resources, whose product has not been improved when organized purchasers manifested concern for quality and sought excellence in products purchased.

There are other manufacturers supplying electrical equipment on the American market, some of which are in America and some of which operate in other countries, whose concern for the reputation of their product, or whose ability to produce a reputable product, is not so apparent. In the past these manufacturers have not had to contend with organized attempts to evaluate their products, but have found a rich, uninformed market in which it was relatively easy to unload equipment whose qualities were not known. The introduction of organized efforts to ascertain qualities of electrical equipment for the guidance of buyers, in proportion as it becomes effective, will compel such manufacturers either to improve their products to bring them to an acceptable grade or to encounter impediments in selling which it is hoped will prove severe.

The Central Stations

Several central stations have, for some time, pursued the policy of selecting with care, and in the light of test results and experienced judgment, the equipment which they have offered for sale to the public. Their efforts, however, have been somewhat spasmodic and far from comprehensive. Too often, bad service experience has taught central stations the importance of ascertaining facts regarding qualities and performance. With qualities and performance characteristics known, central stations can select equipment which they may offer to the public with the assurance that money is well invested therein. Through practice and precept, central stations can influence other dealers into selling higher grade equipment and can bring moral pressure against low-grade equipment which is ineffective, inconvenient or needlessly short-lived.

With the co-operation of the essential elements of the electrical industry, it should be practicable in the near future so greatly to encourage the production and sale of high-grade electrical equipment (and simultaneously discourage the opposite practice) that gradually electrical service will afford to the public the full share of service of which it is capable. The enhanced popularity of elec-

tric service which will inevitably follow should result in larger sales of good equipment, in larger sales of energy for its operation and in enhanced good will for the electrical industry. Such a condition represents no Utopian ideal. It is practicable of realization. It requires only organized efforts to ascertain the facts, followed by decisions and applications based upon the facts. In the words of B. C. Forbes,

"Acts should always be preceded by an F."

Letters from Our Readers

Reason for Dancing Cables

To the Editor of the ELECTRICAL WORLD:

I have been much interested in reading about the phenomena of dancing conductors or cables and thought I might contribute some experiences to this symposium. During 1918 to 1923 I made an extensive investigation in an attempt to find the cause of dancing conductors and remedies for eliminating these conditions. In this connection I studied many lines of different materials and spans and the conclusion was that dancing or wabbling of cables may result from, first, mechanical action; second, electrical action; third, the combined action of mechanical and electrical effects.

The result of my investigation showed that the dancing was due to mechanical action when an electrical conductor or other material is brought to a state of equilibrium. Under these conditions it takes only a little wind or even sometimes the shaking of a pole or tower to start the dancing action. Once this condition obtains, the energy required to keep up the action is almost zero. The condition of equilibrium for conductors is usually reached with wires that are under rather heavy tension—the conductors are strung too tight. Under variable temperature conditions this wire is apt to, with certain wind directions, usually at an angle of 25 to 50 deg. with the conductor travel, start the dancing phenomena. This condition usually results as the temperature drops slowly and it is not necessary that sleet be formed, but sleet in some cases will act as a temperature insulation and so maintain the established critical temperature under which the conductor vibrates longer than ordinarily.

During some experiments I disturbed the equilibrium of conductors at will by sending an electric current of a known order of magnitude through the wires and observing the action which brought the dancing to an end. I also strung conductors so that I could lengthen the span or tighten the wires at will to observe the effect of the dancing phenomena. I have found at times on horizontally strung conductors that the wind, even at 8 to 10 miles an hour velocity, might be deflected from the larger conductors onto smaller conductors and start them dancing. The remedy for this condition was had by changing the sag of the larger conductors.

Experiments on both long and short spans with stranded and solid conductors showed that dancing may take place on any type of installation when the conductors are brought into a state of equilibrium. The usual remedy is to adjust the sag of the conductor to meet the temperature and wind conditions, but on one or two occasions I stopped the dancing by fastening two or three egg-shaped metal pieces on points along the span, these points being indicated as the location of the crest of the vibration wave. In some instances I connected two of the above-mentioned metal eggs by solid metal rods. It must be remembered that large transmission lines run through areas differing greatly in air density, having air pockets and with many possible changes in temperature and wind velocity. Under these conditions there will be spots very favorable to creating the dancing phenomena and otherwise good lines may be in trouble from this effect.

But electrical causes may cause dancing as well as mechanical causes. The generators may have certain characteristics through which a dynamic wave may set up the dancing action in overhead transmission lines, provided the lines are so located and erected to conform to favorable physical and mechanical conditions. This action has even been encountered in underground cable engineering, especially where steel-armored cables are placed directly in the ground.

In my own experience with a medium-sized power plant the cables connecting four generators with the switchboard were placed in a trench filled with fine gravel and were covered to a depth of about six inches. After some months of operation several of the cables came out of the ground; at first it was thought this might be due to ordinary vibration, but when a close investigation was made it was evident that no mechanical reason existed. After studying the situation and relaying the cables at a greater depth and watching carefully their uplift and behavior, I came to the conclusion that the uplift force could be brought in close relation to the time of operation of the generators connected to them.

If a generator or a system of generators with these characteristics are connected to overhead transmission lines which are subjected to mechanical conditions which set up vibration or dancing there is apt to result a tremendously increased dancing effect, or it may work out that the generator action may act against the mechanical action and the resultant conductor vibration will be zero.

Irish Free State,
Dublin Ireland.

P. W. SOTHMAN,
Chief Electrical Engineer.

Porto Rico Manager Finds Rate Discussion Valuable

To the Editor of the ELECTRICAL WORLD:

The articles on rates that you have been running in the ELECTRICAL WORLD recently, particularly "Inducement Rates," March 2, 1929, and "Customer Psychology," April 20, 1929, are excellent.

I believe practically every utility man will agree with the soundness of Mr. Ferguson's thesis, but the problem is how to put proper rates into effect with our political friends pulling the other way. The answer is probably in education of the people along the lines of Mr. Ferguson's talk.

Has it ever been suggested that there might be more uniformity about rate structures in general? Rates nowadays are impossible of comparison. Each company seems to be trying out a different scheme. I am particularly interested in this matter because I am working on a single residential rate with inducement features to substitute for a 10-cent lighting rate and a 3½-cent domestic energy rate requiring two meters.

I hope that you will be able to give us more and more articles on the management end of the utility business.

FREDERICK KRUG,
General Manager.
Porto Rico Railway, Light & Power Company,
San Juan, P. R.

Digest of Electrical Literature

Hydro-Electric Development and Steam Equipment

Electric Supply of Soviet Russia.—G. DETTMAR.—In an endeavor to study the present electrical conditions in Soviet Russia, the author spent five months in the country to investigate what progress has been made on the realization of the so-called Goelro program, established in 1923 by the United Social Soviet Republic. Contrary to previously published reports, very little has been actually accomplished to date. It seems that the unusual amount of bureaucracy and red tape, combined with a decided lack of funds and properly trained men, have greatly retarded the originally planned optimistic program of an electrification of the vast area of European and Asiatic Russia. The author gives tabulations and short descriptions of the existing plants and those in actual process of erection, mentioning their size, yearly output, type of load, and other characteristic features. Particularly interesting is the great number of peat-burning caloric plants and details as to the harvesting of peat and treating of peat-fired boilers. Not less than 24 per cent of all power generated is obtained from peat, 34 per cent from naphtha, 26 per cent from coal and 16 per cent is hydro power. As an up-to-date report on actual conditions in Kussia, obtained from personal observations, this paper is no doubt of great value.—*Elektrotechnische Zeitschrift,* May 9 and 16, 1929.

Transmission, Substations and Distribution

Power Exchange Between Independent Systems.—F. GRIEB.—The paper points out the disadvantages of connecting two independent power systems by means of two synchronous machines or by one synchronous and one asynchronous machine, on account of the rigid nature of such a coupling. To prevent mutual reactions of load changes or frequency variations and to allow power dispatch at any time in any direction a very elastic coupling is the only satisfactory solution. As such, the author recommends one synchronous and one asynchronous machine, the latter connected to a commutator cascade set of the Scherbius type. A similar result can be obtained by the Steinmetz type, in which one system is connected to the stator and the other to the rotor of an induction machine, causing the rotor to revolve with a speed corresponding to the difference of the net frequencies. The energy necessary for the exchange of power or generated as slip energy is delivered to a secondary d.c. machine, connected to an induction motor. Examples are given for these two methods with connection diagrams and description of the required electromechanical control apparatus.—*Bulletin de l'Association Suisse des Electriciens,* May 22, 1929.

High-Conductivity Aluminum Alloy as Transmission Cables.—H. CHAUMAT.—France has to import all of its copper, and since the nation has a large supply of bauxite, the ore for aluminum, the author points out forcefully the national economy of using aluminum alloys for the many transmission lines planned in France. In particular, attention is called to "aldrey," a new high-conductivity aluminum alloy, containing chiefly magnesium. The article points out the various advantages of this alloy. The following comparison is of interest: A 3-mm. wire of hard copper, 1 km. long, cost in March, 1929, 1,050 francs; an aluminum wire of same length and same conductivity—that is, 3.85 mm.—cost at the same time only 487 francs.—*Revue Générale de l'Electricité,* May 4, 1929.

66,000-Volt Atami Power Cable.—A single-core, paper-insulated, lead-covered, jute-served type of high-voltage cable designed and constructed in Japan by Japanese engineers and workmen was fabricated to meet the severe physical conditions of steep grades. The ordinary type of cable, according to this article, would have been unsuccessful in performance as the insulating compound with which the insulating paper is impregnated would probably have been attended by a gradual downflow. Full information regarding the design and material utilized in this construction has been included, as have a few operating data. The cable has been in operation since January, 1928. A high-density paper with modified oil-filled design, hollow conductor, reinforced lead sheath and oil tank of the reservoir and pressure type have been utilized in the installation.—*Far Eastern Review (China),* April, 1929.

Units, Measurements and Instruments

The Differential Method for Measuring the Thickness of Hard Cases.—EDWARD G. HERBERT and PAUL WHITAKER.—The problem of determining the thickness of the case on case-hardened steel without cutting or breaking through it is one that has exercised many minds and by some has been deemed insoluble. According to the authors, the most natural way of approaching this problem is through the hardness test, but any hardness test, depending as most of them do on penetration of the surface by an indentor, merely gives a false reading on case-hardened work, a reading which is liable to be influenced by three variables, namely, the hardness and the thickness of the case and the hardness of the core, but which fails to discriminate or to determine any one of them. The method described by the authors consists in making two different hardness tests, a primary test which measures only one variable, the hardness of the case, and a secondary test which measures the combined effect of two variables, hardness and thickness of case. The difference between the two hardness readings is a function of the second variable, thickness of case. The third variable, hardness of core, may, without serious error, be treated as a constant for any given variety of steel. The two hardness tests used in the differential method are the pendulum time test and the Brinell test.—*Engineering (England),* May 10, 1929.

Motors and Control

Slotted Brushes.—J. KOZISEK.—The performance of carbon brushes on commutators and slip rings can be improved considerably by resolving the solid contact surface of each brush into several smaller surfaces. This can be done by simply sawing slots into the brush in both directions (crosswise). While the exact reason for the undeniable benefit of this slotting is not known, it seems that the gases produced by small sparks under the brush can escape freely without tendency to lift the brush, and that small particles of carbon or copper lodge themselves in the slot crevices. To insure permanent benefit, such brush slots must be cleaned out occasionally. Test records are given of comparative runs made on four differently slotted brushes on collector rings running at high speed.—*Siemens Zeitschrift,* April, 1929.

Motor Drive for Weaving Machines.—J. ELMER.—In all branches of the textile industry the advantages of individual motor drives are so outspoken that general belt drive, or even belt group drive, is hardly considered at all in modern installations. It seems, however, that individual motor drive for weaving machines, with rigid power transmission between motor and weaver, does not represent ultimate satisfaction. The relatively slow start and the gradual stopping in case of a broken thread are undesirable features. So the latest development, proved to be very valuable in several years of experimental operation on a battery of 400 weaving machines, is the individual motor drive with a special friction clutch placed between motor and weaver. The clutch can be engaged and disengaged either manually or automatically in case of a broken thread. Start and stopping of the very light shuttle is very quick, reaching normal speed after the first

throw. A detailed description of the mechanical construction is given in the paper. A specially built, ball-bearing, three-phase motor with hard-soldered winding was found best suited for the purposes.—*Brown, Boveri Mitteilungen,* May, 1929.

Heat Applications and Material Handling

Electrically Heated Hotbeds.—ALFRED EKSTROM.—A recent development in Swedish and Norwegian practices has led to the construction and use of hotbeds, in which the soil is heated by means of resistant wires laid in the bed. The wires are heated by very low-voltage, electric power. Refinements on this original arrangement developed special cables consisting of a resistance wire insulated with asbestos and an impregnated paper ribbon surrounded by an airtight lead covering. This cable is covered with a composition to prevent damage from acid in the soil and from the stray direct current. For this latter development 127 to 220 volts may be used. The details of the arrangement used and an indication of the results which have been obtained, as well as the energy requirements and economies involved, have been included in this discussion. It is stated that at present several hundred gardeners are using electric hotbeds with a total area of about 25,000 sq.yd. and a total load of about 3,000 kw. in Sweden.—*Electrical Review (England),* May 24, 1929.

A Large Transporter Crane.—An outdoor conveyor type of crane of unusual design and size has been installed on the property of a Swiss industrial plant for the economical handling of process materials. This crane is electrically operated by three-phase, 500-volt, 50-cycle energy through a flexible arrangement which facilitates crane operation.—*Electrical Review (England),* May 24, 1929.

Electrophysics, Electrochemistry and Batteries

Continuous Galvanic Plating.—J. W. WOLF.—Many small products of modern industries call for plating, either as a rust protection or to improve their appearance. Certain products being manufactured in large lots, it was desirable to build a mechanical equipment which could do the plating automatically. After preliminary grinding and polishing, the pieces are attached to a traveling endless chain, which carries them through a pickling bath, a washing solution, then through a circular plating bath, and finally through a second washing and drying section. As an example of the economic use of such an automatic plating equipment, the author cites a bicycle factory in which one such machine takes care of the nickel-plating for parts of 500 bicycles per eight-hour shift.—*Zeitschrift des Vereines Deutscher Ingenieure,* May 4, 1929.

Primary Cells.—L. JUMAU.—Every year this magazine presents to its readers a most elaborate descriptive list of French patents issued during the past year for primary cells of the wet and dry type. The list is divided into three main chapters: (1) Cells of the wet and dry Leclanché type; (2) cells with air depolarizer, and (3) odd constructions. The present large demand for dry cells for flash lamps, ignition and radio purposes should make this annual paper of great value to American manufacturers, as it gives a wealth of detailed and constructive information.—*Revue Générale de l'Electricité,* April 27, May 4 and 11, 1929.

Illumination

Illumination vs. Work Efficiency.—M. COHU.—The tests reported in this paper show the influence of light intensity upon the ability of workmen to see distinctly and to perceive quickly. By illuminating the test room with incandescent lamps of between 10 and 1,000 watts a general light intensity of between 0.7 and 140 lux was obtained. It was found that with increasing illumination the amount and the quality of work rises at first very rapidly, but that beyond about 25 lux the efficiency curve becomes practically horizontal, indicating that further increase in lighting has no value.—*Revue Générale de l'Electricité,* May 18, 1929.

Traction

Automatic Substation for Railroad.—J. DARDENNE.—The French Midi railway installed at the end of one of its electrified branch lines, in an otherwise fully attended generating station, two 750-kw. rotary converters with fully automatic control, the object being to study at close range the performance of such equipment for a possible later use of similar apparatus along the road. The rotaries furnish each 750 kw. continuously, 1,125 kw. for two hours or 2,225 for five minutes at 1,575 volts d.c., being supplied from 10,500 volts, 50 cycles, three phase. A time switch starts, synchronizes and stops the two sets at definite, predetermined hours, but a by-pass control switch allows also starting at any desired time. If overload or a "short" on the line trips a feeder breaker, an automatic testing device attempts to reclose it again several times before it remains definitely open. A complete wiring diagram is given of the somewhat unusual equipment.—*Revue Générale de l'Electricité,* April 20, 1929.

Substation of the Paris-Vierzon Railway.—L. VELLARD.—Along this electrified road are placed, on an average of 12-mile intervals, eleven substations, which change the three-phase supply to 1,500 volts d.c. The nearest two stations connect with the metropolitan network of Paris, receiving 13,200 volts by underground cable, while the nine others are fed from the 90-kv. Paris-Orleans transmission line. Depending upon the local road demand, each of these substations has two or three 2,000-kw. rotaries, with the necessary self-cooled transformer equipment. Since some of the stations are also supplying local power and light demand, additional sets of motor-generators or mercury-arc rectifiers for lower d.c. voltage are installed in some of them. The total output of these eleven stations is 54,000 kw. for traction purposes. Substations No. 3 to No. 11 are all of the outdoor type, while the first two plants near Paris have all parts housed in buildings. Descriptions are given of some of these typical installations.—*Revue Générale de l'Electricité,* May 11, 1929.

Telephony, Telegraphy, Radio and Signals

The New Interurban Telephone Central in Berlin.—O. KUHN.—For long-distance calls from, to and through Berlin, a new exchange building was opened on May 18, a detailed description of which is given in this paper. Into the exchange lead 38 cables with about 10,000 double lines and 50 overhead lines. There are 200 male and 1,470 female operators, handling per day 30,000 incoming, 23,000 leaving and 3,500 throughgoing messages, as well as 3,000 informations. Operating power is obtained from two 400-hp. steam-turbine-driven, three-phase generators, and in an emergency from the Berlin city supply. A 200-hp. air compressor serves the pneumatic mail-carrying system within the building. Numerous storage batteries, motor-generators and one mercury-arc rectifier furnish the large demand for direct current of various voltages.—*Zeitschrift des Vereines Deutscher Ingenieure,* May 25, 1929.

Miscellaneous

X-Ray Technique.—Theoretical and practical investigations concerning applications of X-rays in industry are covered in a symposium of six major papers and numerous notes. In two articles the present status of inspecting the internal structure of metal and alloy pieces is given. Expectations were formerly rather optimistic and have hitherto not been fulfilled to such an extent as may have been desirable. With most up-to-date equipment steel of only 1¼ thickness requires nearly 30 minutes exposure, and the result suffers much by fogging due to secondary rays. Much wider application may be expected from investigations of the crystalline structure of metals by the use of X-ray interference pictures or so-called Laue diagrams. Much valuable information is given in a paper on X-ray equipments for routine factory use, built to withstand daily operation and semi-skilled attendance. In a theoretical paper the efficiency of X-ray output is computed and the most suitable apparatus for a maximum output explained.—*Elektrotechnik und Maschinenbau,* April 21, 1929.

News of the Industry

Proclaims Six-State Pact

President Hoover Puts Long-Deferred Treaty on Colorado River Into Effect, Expressing Hope that Arizona Will Yet Ratify

INFORMED by the Attorney-General that Utah's ratification of the Colorado River treaty entered into at Santa Fe, N. M., six years ago is valid, President Hoover has declared it in effect, his signature being affixed to the formal proclamation on Tuesday, June 25. Congress in the Boulder Dam act, passed last December, made the treaty effective as soon as six states should ratify it. Utah and Arizona were at that time non-signatories. Now only Arizona of the seven Colorado Basin states — Wyoming, Colorado, New Mexico, California and Nevada being the others—remains in opposition to the agreement.

In a statement issued by President Hoover he voiced the hope that Arizona and California "may compose their mutual problems which have hitherto prevented Arizona from joining in the compact." Characterizing the treaty as the "most important action ever taken in that fashion under the Constitution," the President added that "with Arizona in, the whole basin will have settled the major question of water rights for all time."

Guarantee Power Market for Boulder Dam

Los Angeles Bureau and Three Big Central-Station Companies Promise to Buy Maximum Output—Commissioner Mead Predicts Work Will Start in Ten Months

PURCHASE of the maximum power to be developed by Boulder Dam was guaranteed by representatives of the Los Angeles Bureau of Power and Water, the Southern California Edison Company, the Los Angeles Gas & Electric Corporation and the Southern Sierras Power Company in conferences with Dr. Elwood Mead, United States Commissioner of Reclamation, at Los Angeles on June 25 and 26. Although details of the meetings of the officials were not disclosed, it was learned that the applicants for power contracts are divided in their opinions on the "falling water" policy of the government. The Southern California Edison Company, it was said, favored construction by the purchasers of a hydro-electric plant, while the Bureau of Water and Power preferred that the government should build and operate the generating system.

A statement issued by George C. Ward, executive vice-president of the Edison company, said that his company, "either in conjunction with other agencies or by itself, will agree to utilize all the power of the falling water at Boulder Dam and to pay therefor the maximum price that can be paid without financial loss." Los Angeles, Gas & Electric officials said that their company was willing to participate in the distribution of power from the river. Southern Sierras Power Company representatives stated that their company was ready to take power up to the full capacity of their lines at the maximum price at which their own company could generate power at their own plant.

Officials of the State of Nevada met with Dr. Mead in an attempt to work out a plan for distribution of some water in Nevada. Commenting on the co-operative attitude with which the power companies have met this issue, Dr. Mead predicted that "under favorable conditions construction will begin in ten months."

Delegates from Colorado, Wyoming, New Mexico and Utah, the four upper basin states of the Colorado River, will meet in Denver in September to allot their share—7,500,000 acre-feet—of the Colorado River water.

Institute Assembles at Swampscott

Summer Meeting of A.I.E.E. Combines Technical Study, Entertainment and Exploration in Fitting Proportions—Two Medals Go to English Engineer

COMBINING happily business with recreation, the midsummer convention of the American Institute of Electrical Engineers, held at Swampscott, Mass., from Monday to Friday of this week, scored a complete success. Monday was given over to registration, conferences and branch delegates' meetings, and Wednesday morning to commitee reports, of which eighteen were presented in two parallel sessions. Thursday was "a day off," the whole day being taken up by a trip to Rye Beach, Me., during which acquaintanceship was fostered and rest and amusement were enjoyed. The only afternoon technical session was on Wednesday. Others were held on Tuesday and Friday mornings, the afternoons of these days being devoted to the lighter side of the gathering. Historic towns, industrial establishments, scenic beauties and the seashore were visited by the delegates and their friends in great numbers.

Seven hundred and fifty persons registered in the opening days. President R. F. Schuchardt's address on "The Engineer, Practical Idealist," elicited a hearty response from the practical idealists to whom he spoke. Prof. Harlowe Shapley of Harvard delivered a popular lecture on Tuesday evening on astronomy, in which he discussed problems of spatial measurement and illustrated galactic formations many light-years distant. It drew a good attendance of both engineers and laymen.

In the course of Tuesday's proceedings President Schuchardt presented the national prizes for papers by Institute members. That for the best paper on engineering practice went to Philip Sporn for his treatise on "Rationalization of System Voltage and Insulation," and that for the best paper on scientific investigation to Dr. Joseph Slepian for his paper on "Extinguishing Alternating-Current Arcs."

At the Wednesday evening banquet the leading event was the presentation of the Lamme medal and the John Scott medal to Allan Bertram Field of Manchester, England. President Schuchardt, Prof. C. F. Scott of Yale, B. A. Behrend of Boston, Secretary F. L. Hutchinson, Dr. Elihu Thomson, Charles L. Edgar, Ambrose Swasey and the recipient of the double honor spoke, paying tribute to the late B. G. Lamme, outstanding electrical engineer, and reviewing jointly some of the scientific achievements that have made the electrical development of today possible.

Two especially noteworthy technical items were the symposium on "Synchronized at the Load," and C. F. Hirshfeld's paper on "Rehabilitation and Rebuilding of Steam Power Plants"—both being presented on Tuesday morning, when a parallel session was devoted to electric transportation subjects. Wednesday afternoon miscellaneous topics, including communication, were dealt with. All these sessions, as well as those of Friday—including a symposium on shielding and papers on electrical machinery—and the presentation of the medals, will be reported more fully in next week's issue.

New Officers Announced

Announcement was made at the convention that, as the result of the mail ballot and as already printed, Harold B. Smith, professor of electrical engineering at Worcester Polytechnic Institute, was elected president for the year beginning August 1. The new vice-

presidents are: E. C. Stone, Pittsburgh; W. S. Rodman, Charlottesville, Va.; Herbert S. Evans, Boulder, Colo.; C. E. Fleager, San Francisco, and C. E. Sisson, Toronto. New directors: J. E. Kearns, Chicago; W. S. Lee, Charlotte, N. C., and C. E. Stephens, New York. Other vice-presidents and directors hold over.

Institute Elects Three New Honorary Members

Three distinguished American engineers were elected honorary members of the American Institute of Electrical Engineers at a meeting of its board of directors held June 25 during the annual summer convention of the Institute in Swampscott, Mass. The men thus honored were President Herbert Hoover, Charles F. Scott, head of the electrical engineering department of Yale University and past-president of the Institute, and the late Charles F. Brush, engineer, scientist and recipient of the Edison medal, whose death occurred as he was being balloted upon.

Five other Americans and three representatives of foreign countries had previously been elected as honorary members of the Institute. The Americans are John J. Carty, Thomas A. Edison, Michael I. Pupin, Ambrose Swasey and Elihu Thomson.

"Movietones" at Pacific Coast Convention

Edison, Benn, Irving Langmuir and President-Elect Sloan Make Their Bow on the Screen—Other Addresses and Features Mark Successful Meeting

BY MEANS of talking motion pictures "high lights" of the N.E.L.A. national convention at Atlantic City were brought to the 585 members of the Pacific Coast Electrical Association who met at Del Monte, Calif., June 19-22 for the thirteenth annual convention of that body. In this manner President-Elect M. S. Sloan of the national association, who was unable to attend the convention in person, delivered a message to the West Coast association. Likewise Thomas A. Edison was heard speaking from his home, Sir Ernest Benn spoke from London on the superiority of private enterprise, and Dr. Irving Langmuir of the General Electric Company delivered a lecture on atomic hydrogen.

President Sloan emphasized the necessity of central-station companies concentrating on the domestic market, pointing out that commercial men have not fully "sold" the American home on the benefits of electricity. Rate structures are not yet right and a real inducement rate is needed, he declared.

Vice-President J. F. Owens, who attended the convention in person, made an excellent address at the opening session on the theme of human values in business. He pointed out that great energy has been given to the material aspects of the light and power business in the past and that now the industry must devote its attention to its human aspects.

In his presidential address P. M. Downing stressed the necessity for greater efficiency in all departments in order that rates may still further be reduced and electric service may become more widely and extensively used.

At the one meeting of the Commercial Section Chairman J. F. Pollard gave a résumé of notable accomplishments by the section in the past year. They include a handbook for agricultural power salesmen which will be distributed throughout the country. The commercial organization of the Central Arizona Light & Power Company and a group plan for selling three major appliances—range, water heater and refrigerator—were described by A. F. Moriarty.

A talk on the purpose of and plans for "Light's Golden Jubilee" was made by H. M. Crawford. In an address on "Psychological Merchandising" A. Edwin Fein said that electrical merchandising managers should take advantage of the fact that health and food preservation are foremost in the public mind to push the sale of electric ranges and refrigerators. Results of a careful study of Diesel engine operating costs and competition with central-station service were presented by W. K. Chawner.

Chairman N. B. Hinson of the Engineering Section reported at length on its accomplishments. Two valuable papers, one on improvements in distribution practice by D. K. Blake and one on metal-clad switch gear by A. W. Copley, filled out an afternoon session.

Addresses and special features were included in general sessions Thursday, Friday and Saturday. Several skits and playlets held the attention of the audience.

At the concluding general meeting Saturday morning Paul S. Clapp, managing director N.E.L.A., declared that the industry is making real progress toward complete electrification of America. Interconnection has made possible an ample supply of low-priced dependable power for industry, but there is a need for more aggressive large-scale business development, he asserted.

"Light" found its way into three features of the general sessions, and throughout the convention light and lighting effects played a dominant rôle. A novel and spectacular effect was produced when the beautiful Del Monte Hotel grounds were lighted for the first time on the evening of the opening day by a radio beam from a flying airplane.

Officers elected for the ensuing year were: President, E. B. Criddle, Southern Sierras Power Company; first vice-president, A. M. Frost, San Joaquin Light & Power Corporation; second vice-president, A. B. Day, Los Angeles Gas & Electric Corporation. The convention next year is to be held jointly with the national convention, which is expected to meet in San Francisco in June.

Screen and Platform Speeches Interest Northwest Men

Talking motion pictures introducing Thomas A. Edison, Sir Ernest Benn and President-elect M. S. Sloan of the N.E.L.A. were a feature of the twenty-second annual convention of the Northwest Electric Light & Power Association, which met at Seattle on Wednesday to Friday of this week, the last session being held on an excursion steamboat en route to Victoria, British Columbia. Besides the Accounting, Commercial, Public Relations and Engineering Section reports, presented by the respective chairmen, the program included addresses by A. W. Leonard, Franklin T. Griffith, President R. M. Boykin, John B. Fisken, W. H. McGrath and other well-known Northwest electrical men.

Dr. Henry A. Burd, College of Business Administration, University of Washington; Prof. Karl E. Lieb of the same university and George E. Erb, former chairman Idaho Public Utilities Commission, were the outsiders scheduled to address the meeting, and Vice-President J. F. Owens of the national body was also to speak. A fuller report will appear in a later issue of the ELECTRICAL WORLD.

Eighty-eight Attend W.L.I. Illumination Conference

With a registration of 88, the first annual illumination conference of the Westinghouse Lighting Institute, held in its commodious quarters in the Grand Central Palace, New York, on Monday, Tuesday and Wednesday of this week, scored a complete success. The program as printed in the ELECTRICAL WORLD of last week (page 1302) was faithfully carried out, special emphasis being placed on decorative and spectacular lighting in connection with "Light's Golden Jubilee."

A particularly valuable address was given on Wednesday by LeRoy Kern, technical secretary of the American Institute of Architects. Mr. Kern's subject was "How the Central Station Can Help the Architect." He told why and how the lighting engineer and the architect should get into closer contact and touched on the advantages that would follow a clearer understanding on the part of each concerning the other's motives and methods and the need for a common language in the interchange of their ideas.

Canada's Future Built on Her Hydro Wealth

Delegates to Electrical Association, Meeting in New Brunswick, Cheer This Declaration—Matters of Interest Fill Three-Day Convention

MATTERS of no little importance to the electrical industry of Canada were discussed at the annual convention of the Canadian Electrical Association, held at St. Andrews-by-the-Sea, New Brunswick, from June 19 to 21 inclusive, with an attendance of approximately 250 delegates. This was the first time the convention had ever been held in the Maritime Provinces. Business and social pursuits were mingled in a highly successful way.

The chairman of the Public Relations Section, R. H. Mather, reported that the work in the relations with government regulatory bodies had been of great interest, mainly through efforts from certain quarters to have the regulations of the Dominion Board of Railway Commissioners with regard to crossings amended in connection with liability for damages and to define the spacing of conductors erected in a horizontal plane. In Quebec the drawing up of a standard form of contract for domestic service had been the outstanding question during the year.

In the course of an address delivered at a banquet on the evening of the opening day, J. B. M. Baxter, Premier of New Brunswick, observed that the fruit of having Grand Falls developed by private interests was already seen. The Fraser companies had enlarged their facilities. There was in course of construction at Dalhousie a paper mill which would employ a thousand men the year round, and other large developments were also under way.

On the second day there was a discussion on the Canadian Electrical Code. W. P. Dobson, chairman of the committee of the Canadian Standards Association dealing with a code for Canada, said that the rules for inside installations had been adopted as a standard and were now in force in several of the provinces. The question of grounding presented a real difficulty, especially as it was not yet known what efficient grounding really was. G. E. Templeman, chairman of the overhead and underground systems committee, said his committee was still procuring information on the use of the common-neutral systems for grounding and hoped to have enough data to report soon. E. V. Caton said that the four-wire grounding system was in use in Winnipeg and no trouble with it had been reported.

An expression by C. H. Cahan, member of Parliament for Montreal, of his belief that as England was saved from economic destruction after the Napoleonic wars by the introduction of steam, so Canada was bound to take the lead in the industrial world in the coming years by reason of her great wealth in hydro-electric power, was greeted with much applause.

Officers elected for the ensuing year are as follows: President, P. S. Gregory of the Shawinigan Water & Power Company; vice-presidents, G. R. Atchison of the Southern Canada Power Company, G. S. Parker of the Gatineau Electric Light Company and Alex D. Robb of the Canadian Niagara Power Company; treasurer, C. W. Hemming; secretary, H. M. Lyster. All were re-elected except Mr. Robb.

Purchases and Mergers

The Maryland East Coast Utilities, Inc., has asked the Maryland Public Service Commission for leave to acquire the Millington Light & Power Company, the Cecilton Electric Light & Power Company, the Love Point Light & Power Company and the Trappe Electric Light Company.

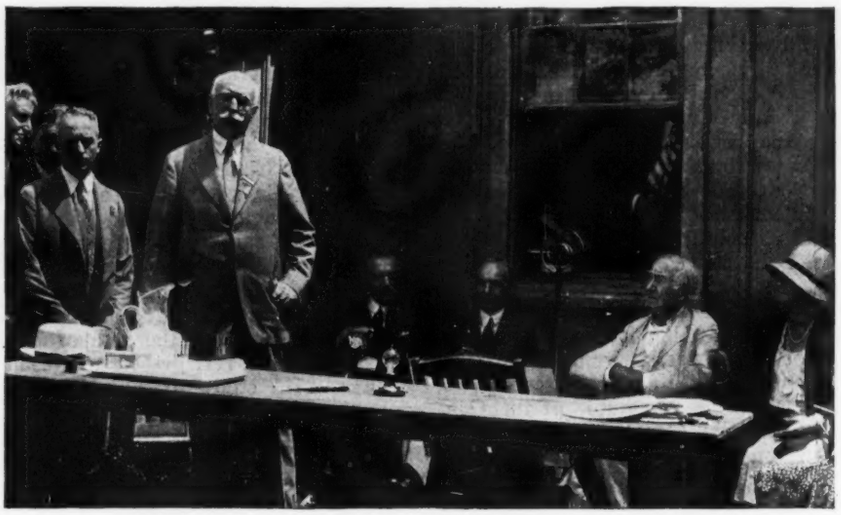
The city of Danville, Va., has had another cash offer for its public utilities, P. J. Mink & Company of New York asking Mayor Harry Wooding, in a letter, if it would consider $4,000,000 cash.

Transfer of a number of small electric distribution lines and systems in Spartanburg County, S. C., to the Southern Public Utilities Company by the Wateree Power Company has been recorded at Spartanburg.

The Union City (Ind.) Electric Company has been sold by the National Electric Power Company to the Midland Utilities Investment Company. The company last named has sold to the Ohio Electric Power Company the Rockford (Ohio) Light & Power Company. All are Insull concerns.

The Nebraska Electric Power Company has been merged with the Western Public Service Company and with the completion of a new tie-up will serve a very large section of western Nebraska. Both companies have been Eastern Texas Electric Company (Delaware) subsidiaries with offices at Scottsbluff, Neb., and under Stone & Webster management.

Cradle of Electric Lamp Goes to Henry Ford



Left to right—Osborn, Barstow, Lieb, Ford, Edison, Mrs. Edison

THE original glass-blowing house from Edison's laboratory at Menlo Park, N. J., one of the authentic relics of the early days of the electrical industry, was presented to Henry Ford last Saturday morning. This one-and-a-half-story frame building, in which the Edison electric lamp was first produced, was given by the General Electric Company, in whose possession it had been for some time, to Mr. Ford for inclusion in the Edison Institute at Dearborn, Mich.

Presentation ceremonies took place on a grassy plot at "Mazdabrook," a General Electric employees' recreation center in Parsippany, N. J. George C. Osborn, of the Harrison Lamp Works of the General Electric Company, officiated at the ceremonies and introduced to the several hundred guests W. S. Barstow, who as president of the Edison Pioneers paid his tribute to Mr. Edison and presented in turn John W. Lieb, the chairman of the Pioneers' national committee formed to sponsor "Light's Golden Jubilee."

Formally to transfer the building to Mr. Ford, Mr. Osborn handed him the old brass key to the door, and Mr. Ford then presented it to Mr. Edison, who accepted it as a memento of the occasion. The first board to be removed was then taken down by the two friends and marked by both for shipment to Dearborn.

It was a great day for electrical history. Motion-picture cameras ground, shutters of news cameras snapped and reporters buzzed around. Everything was arranged for the recording and picturing—even to the making of a wax impression of the inventor's hand. Patient, but a little tired, the chief actors did their part. During a lull in the program the white-haired inventor entered the low-roofed, glass-sided outer room and was seen to regard intently the features of those pictured in a half-century-old photograph on the wall. The group examined, he lifted his shoulders a bit wearily, remarked to himself, "All gone—dead," and then turned to greet with a friendly smile a dozen eager youngsters who stood nose-close against the window.

S. P. E. E. on the Graduate and His Work

Ohio State University Meeting of Society Sounds Optimistic Note Concerning Engineering Education and Its Proper Co-ordination with Industrial Tasks

ADOPTING "The Graduate and His Work" as its general theme, the Society for the Promotion of Engineering Education held its thirty-seventh annual convention on June 19-22 at the Ohio State University, Columbus. More than five hundred members, delegates and guests were in attendance, the largest registration reported since the founding of the society in 1893. Ohio State University had been host once before, thirty years ago.

An event of particular importance was the awarding of the Lamme medal, the gift of the late Benjamin G. Lamme, to Irving Porter Church, professor emeritus of mechanics and hydraulics at Cornell University, in recognition of outstanding contributions to engineering education both as teacher and author. In the absence of Dr. Church, Prof. Paul M. Lincoln made the acceptance speech, recalling Mr. Lamme's interest in engineering education and the first award of the medal, in 1928, to Prof. George F. Swain of Harvard.

At the opening session the visitors were welcomed by Dr. George W. Rightmire, president of Ohio State, who paid tribute to the work of engineers in government, research and industry. Dexter S. Kimball, dean of the College of Engineering, Cornell University, and president of the society, responded and introduced the subject of "The Graduate and His Work." This general theme was a natural outgrowth of the recent investigation of the co-ordination between education and industry, a study of standards of quality and performance such as are demanded of the products of industry. R. I. Rees, assistant vice-president American Telephone & Telegraph Company, and C. R. Dooley, manager of personnel and training, Standard Oil Company of New York, presented the side of industry and called particular attention to the present demand for technical graduates, so keen that companies send representatives to the colleges rather than wait for the graduates to make applications. The representatives of engineering schools, who indicated the demand for graduates and the large proportion of graduates who remain in technical work, were Dean H. S. Evans, University of Colorado: Director Paul M. Lincoln, Cornell: Dean Louis Mitchell, Syracuse, and Prof. W. T. Magruder, Ohio State.

In his presidential address, "The Economic and Social Significance of Engineering," Dean Kimball ridiculed fears of theorists that the world is becoming mechanical and soulless because of the work of the engineer, maintaining, on the contrary, that society is benefiting spiritually as well as physically by his ingenuity.

Dean E. A. Hitchcock, Ohio State, struck a sympathetic chord in his address, "Some Reflections on Engineering Education." He held that educational theorists, continually erecting additional hurdles for the students, are unduly pessimistic about the character of the embryo engineers in their charge.

Other addresses were made by Sam A. Lewisohn, vice-president of the Miami Copper Company, who presented the need for proper instruction in labor relations; L. W. Wallace, secretary of the American Engineering Council, who described the work of the council in making the services of the engineer available for public benefit, in achieving standardization and elimination of waste and in making progress toward uni form traffic codes; Arthur E. Morgan, president of Antioch College, who outlined the plans for Mississippi River flood control, and Prof. William L. Evans, Ohio State, who told of the methods used in teaching chemistry.

Co-ordination of preparatory and engineering education, industrial aptitudes of technical graduates and instruction of personnel were subjects of special committee reports. Student branches of the national engineering societies were considered in a special conference of engineering educators and representatives of the societies. In another conference engineering problems and orientation were discussed. W. E. Wickenden, newly elected president of the Case School of Applied Science; H. P. Hammond, professor of civil engineering at Brooklyn Polytechnic Institute, and R. H. Spahr, member of the S.P.E.E. staff, reported on the activities of the board of investigation and co-ordination.

The conferences, which in a crowded program could not be attended by all who were interested, were provocative of much valuable discussion. The English conference was marked by pleas for more time for English instruction and by statements that it is unfortunate that the impression has got out that the English of the engineer is inferior to that of other professional men. At the industrial engineering conference the relative values of the school shop and the outside shop were considered, the school shop winning overwhelmingly.

The conference on electrical engineering was devoted to the relation of the undergraduate curriculum in electrical engineering to work after graduation. Prof. H. H. Higbie, University of Michigan, pointed out the need for co-operation of industry in training illuminating engineers; Prof. W. L. Everitt, Ohio State University, presented lecture-room demonstrations of phenomena in communication engineering, and Prof. R. W. Sorensen, California Institute of Technology, discussed incentives to scholarship and interest.

During an evening smoker, a lecture was delivered by Phillips Thomas, Westinghouse Electric & Manufacturing Company, on "By-products of Radio."

General R. I. Rees, American Telephone & Telegraph Company, was elected president for 1920-1930. The new vice-presidents are Prof. Edward Bennett, University of Wisconsin, and Dean E. A. Hitchcock, Ohio State. Professor F. L. Bishop, University of Pittsburgh, was re-elected secretary and W. O. Wiley treasurer. McGill University, Montreal, was chosen as the meeting place for the 1930 convention.

In the Legislative Mills

Illinois Legislature Adjourns Without Enacting Any Important Utility Bill Outside of Traction Field—Wisconsin Still in Session

ONLY the Wisconsin Legislature now remains in session in the Northern States, Illinois having followed the example of Massachusetts and adjourned.

ILLINOIS.—The eight Chicago traction bills, one of which applies to downstate also, were approved by Governor Louis L. Emmerson the day before the General Assembly at Springfield adjourned without day, June 20. The terminable-permit measure applies to the entire state. The bills, which carry a referendum clause for any ordinances drafted under them, will be enacted July 1.

Two approved bills fathered by Senator Carlson remove from the public utilities act the provisions relating to the appointment of the secretary of the Illinois Commerce Commission, his term of office and salary and the salary of each commissioner, leaving these powers to the administrative code, and authorize cities to lease public utilities under the harbor act of 1913 for a period not to exceed 25 years, on terms and conditions to be prescribed by ordinance, to the Inland Waterways Corporation or other corporation a majority of whose capital stock is owned or controlled by the United States government. The latter bill provides for a referendum.

No measure of much importance among the numerous other bills affecting utilities that were introduced in the late session became a law.

WISCONSIN.—Last week the Assembly passed the two remaining important utility measures under suspension of the rules. These are the Reis power district bill, which provides a method for the organization of districts to own and operate utilities, and the Loomis bill to authorize cities and villages to build and operate their own utilities without first obtaining a certificate from the Railroad Commission.

The Senate committee on corporations and taxation is now holding hearings on the two bills.

The Rowlands bill prescribing that

electric utilities that engage in the electrical appliance retail business must keep separate accounts of the appliance end of the business was advanced to engrossment in the Assembly without debate. The utilities are not opposing the measure.

The Senate committee on corporations and taxation held its first hearing this week on a bill providing that all electric, gas and electric railway properties shall pay taxes at the average state rate.

T. D. Crocker on "Trading Places with Ontario"

Comparison of Minnesota and the Canadian Province Leads Him to Defend Private Ownership Before North Central Electric Association

ONE of the chief addresses made at the annual meeting of the North Central Electric Association, briefly reported with the names of the new officers last week (page 1299), was that of T. D. Crocker, who spoke at the dinner on Monday evening, June 17, on "Trading Places with Ontario," making a defense of private ownership of electric utilities. Mr. Crocker, who is assistant general manager of the Northern States Power Company, Minneapolis, said:

"If the Province of Ontario were compelled to build steam-power and water-power plants to serve its load, with the hydro conditions we have in Minnesota, the building of 113 water-power plants would be necessary to equal the present facilities. To these water plants Ontario would have to add more than 700,000 hp. in steam capacity to supply the deficiency in low-water periods, and all this would entail the collection of more than twice the revenue now collected."

In addition to the events reported last week, C. W. McDonnell, chairman of the Board of Railroad Commissioners of North Dakota, discussed regulatory legislation and problems.

Business meetings and sectional discussions were well attended, and a good sports and entertainment program helped to make the gathering a notable one.

Indiana Public Service Ready to Build at Michigan City

Final plans for the large electric generating station to be built on the lake front at Michigan City, Ind., by the Northern Indiana Public Service Company have just been announced. The plant, which will be ready for operation in the spring of 1931, will cost in the neighborhood of $9,000,000. Sand-colored brick, with Indiana limestone trim, will be used for the exterior of the building, which will be expanded as necessary. The initial installation will be one 68,000-kw. turbo-generator.

The station, which was designed by Sargent & Lundy, Chicago, is to be 405 ft. long, 155 ft. wide and 114 ft. high, with a 250-ft. stack.

Denver Gets Permit from Power Board

City Contemplates 79,000-Hp. Plant on South Platte River—Other Permits Granted—Status of Columbia and Holston Rivers

AUTHORIZATION from the Federal Power Commission of a preliminary permit for the city and county of Denver, covering a 79,000-hp. project on the South Platte River, was granted at a meeting on June 14. A permit was also authorized for the Fargo Engineering Company of Jackson, Mich., covering a 4,000-hp. project on the Kalamazoo River, 14 miles below the city of Allegan. Other permits granted were for the Virginia-Carolina Power Company, covering a project on the Roanoke River at Buggs Island, and for a 600-hp. project on Blacksmith Creek, Utah, near Hyrum City.

Acting on the declaration of intention of the Maverick County Water Improvement District No. 1, of Eagle Pass, Tex., the commission held that it did not have jurisdiction over the proposed installation of 7,200 hp. on a diversion from the Rio Grande.

The company having indicated its intention to undertake at this time no development of a site on the Grande Rondo River in Wallowa County, Ore., the preliminary permit issued to the Eastern Oregon Light & Power Company was canceled. The city of Dothan, Ala., surrendered its license covering a power project on the Choctawhatchee River. Failure of the American River Water & Power Company of Auburn, Calif., to satisfy the commission as to its ability to finance a project on the North and Middle Forks of the American River has led the commission to reject its application for a preliminary permit, although thirty days were allowed for the company to appeal.

The commission approved the proposal of the Inland Power & Light Company to lease three of its projects to the Pacific Power & Light Company. The projects involved are on the South Fork of the Clearwater River in Idaho, on the East Fork of the Wallowa River in Oregon and on the Clearwater River in Idaho.

The temporary license of the Niagara Falls Power Company covering the 275 cu.ft. formerly used in Eighteen-Mile Creek has been extended until August 31. It is believed that arrangements will have been completed before that date which will permit the issuance of a preliminary license.

Columbia and Holston Rivers

As construction was not begun on its Priest Rapids project, on the Columbia River, within the period prescribed in the license, the commission has terminated the license issued the Washington Irrigation & Development Company on March 5, 1925. The commission has informed Senator Jones of Washington that it is not practicable to withhold the issuance of further water-power permits on the Columbia River until a conclusion has been reached in connection with the development of the Columbia Basin project. He was assured, however, that before any rights were granted on the Columbia River he and all others interested would be notified.

Action of the Tennessee Public Utilities Commission in awarding a certificate of convenience and necessity to the Holston River Power Company for an extensive development of the South Fork of the Holston River near Kingsport, Tenn., means that the Federal Power Commission will take prompt action in granting the necessary federal rights to the company. The Holston River company has had an application for a preliminary permit before the Federal Power Commission since December 2, 1922. The commission has not acted upon it awaiting more definite engineering data which were being compiled in connection with the survey of the Tennessee River.

Many applications for licenses are pending before the commission. These will be noted next week.

Scenery Preservation Not Power Board's Duty

Chief Counsel of Federal Commission Gives Opinion to This Effect—Opponents of Cumberland Falls and Other Projects Took Contrary View

IT IS NOT within the authority of the Federal Power Commission to reject an application for power development on the ground that it may mar scenic beauty. This stand is taken in a formal opinion recently handed down by the chief counsel of the Federal Power Commission. The solicitors of the Departments of War, Interior and Agriculture concur in his views. The document has been laid before the three Cabinet members forming the Federal Power Commission, who will give the opinion personal study. They expect to be able to announce their concurrence or dissent with the opinion at the next meeting of the commission.

The question of the authority of the commission to reject an application on the allegation that scenic attractions would be injured was raised in connection with the Cumberland Falls project. Chief Counsel Call of the commission holds that the wording of the law providing that a project "shall be best adapted to a comprehensive scheme of improvement and utilization for the purpose of navigation of water-power development and of other beneficial public uses" was intended only to secure a comprehensive plan whereby all such uses may be effected. While the commission may issue the license with conditions for the preservation of scenic attractions, they must be in harmony

with the plan of power development. If this decision is adopted by the commission, it will have a far-reaching effect upon other proposed projects where scenic beauty is being urged as a reason why the application should be denied.

Governor Roosevelt to Investigate Morgan Merger

Asked what action, if any, he meant to take concerning the formation under J. P. Morgan auspices of the Niagara-Hudson Power Corporation, merging the Buffalo, Niagara & Eastern Power, Mohawk-Hudson Power and Northeastern Power corporations, Governor Franklin D. Roosevelt of New York said, on returning to Albany from Massachusetts late last week:

"I have ordered an investigation of this power merger from two different angles, because I want to find out what it is all about. I have asked two persons to look into this thing for me and I hope to receive a report within a few days. For the past few days I have only had a chance to look over the headlines of the newspapers, and that is why I do not know anything about this merger. The gentlemen whom I have named will make a report to me as soon as they complete their investigations."

The Governor was asked to define the two angles from which the investigation would be conducted, but again he declined to be specific. He intimated that the report, when it was received, would receive careful study.

Roosevelt Predicts Political Alignment Over Power

Speaking before a Democratic gathering at Boston on June 20, Governor Franklin D. Roosevelt of New York predicted that the power issue would become an important one as between the Republican and Democratic parties. He said:

In New York at the present time only the lives of the Governor and Lieutenant Governor stand between the retention by the people of their property and its alienation. We seem to have forgotten the old difference between capital going to purely private ventures and capital going into public service corporations. The public service corporations have got, little by little, that which in the first instance they never dreamed or expected to get.

With dozens of holding corporations hopelessly mixed up to a condition where it is necessary to go through a maze to reach the real owners, the average man in the street has become greatly confused. The public will get the facts after a while, but it will take a long, long while.

We in New York and Massachusetts are showing the way. We believe that there are some state rights which are left to us and that all of the rights do not go to the federal government. It may be that in the future under Republican rule all the industries will be owned by three or four or five corporations and the rest will be subsidiaries. Well, we want to serve notice right now that the Democratic party will not be a subsidiary.

Briefer News

ALLIANCE (OHIO) COMPANIES REDUCE RATES 10 PER CENT.—A general reduction of 10 per cent in all electric rates over its entire system has been announced by the Suburban Light & Power Company of Alliance, Ohio, affecting customers of that company and allied utility concerns.

ANOTHER ARKANSAS TOWN CONTEMPLATES MUNICIPAL PLANT.—The City Council of Russellville, Ark., has decided on a survey with the idea of building a municipal generating plant, cost of which is estimated at $155,000, $50,000 of this being for a distribution system. Russellville is now served by the Arkansas Power & Light Company.

MOBILE'S NEW "WHITE WAY."—Work will be started on the extension of the "white way" system in Mobile, Ala., within the next few weeks, bonds having been sold by the city for financing the project. The new program extends the white way to several of the principal streets of Mobile, including the entire length of Government Street.

A.E.C. APPOINTS COMMITTEE ON COUZENS BILL.—To study the effects of the legislative proposal of Senator Couzens of Michigan with regard to regulation of communication by wire or wireless and the interstate transmission of power, the American Engineering Council has appointed a committee composed of E. F. Wendt (chairman), O. H. Caldwell, C. B. Hawley, Dexter S. Kimball and Frank A. Scott.

IOWA TOWN STICKS TO MUNICIPAL PLANT.—Voters of Bellevue, Iowa, have rejected a petition of the Interstate Power Company for a light and power franchise in the municipality by a vote of 768 to 54. The utilities company asked leave to withdraw its application a week before the election date but was refused. Bellevue is supplied by a municipally owned plant, but the Interstate recently constructed high-tension transmission lines across the county and through the town.

EDISON LAMP WORKS START A MAGAZINE OF LIGHT.—*Revenue, the Magazine of Light,* has made its appearance as a journal of lighting progress and promotion published for central-station executives by the Edison Lamp Works of the General Electric Company at Harrison, N. J. The first (June) issue has articles by B. C. Forbes, Commander Edward Ellsberg, Lincoln G. Dickey, general manager of Atlantic City's new auditorium; W. J. Wells, general manager of R. H. Macy & Company, and Francis Jehl, only surviving member of Thomas A. Edison's original laboratory assistants. In addition, the issue contains a discussion of the relation of voltage to service and revenue by O. P. Anderson, an article on summer garden floodlighting by A. L. Powell, and a section devoted to novel applications of light in displays by R. R. Carlier. J. W. Milford is the editor of the new publication.

SALT LAKE CONVENTION OF A.S.M.E.—At the semi-annual meeting of the American Society of Mechanical Engineers to be held at Salt Lake City July 1 to 4 a paper on modern practice in the installation and starting of hydro-electric units will be presented by Charles V. Foulds. The fuel and smoke problem in Salt Lake City will be discussed by George A. Orrak and W. H. Trask, Jr. Bingham will be visited and its copper mines inspected.

WISCONSIN ACCOUNTANTS MEET.—Among the papers that marked the program of the Accounting Section convention of the Wisconsin Utilities Association, held at Sheboygan on June 20 and 21, were: "Recent Tendencies in Utility Consolidations," by G. C. Mathews, Wisconsin Railroad Commission; "Some Differences Between Municipally Owned and Privately Owned Public Utilities," Howard L. Smith, Madison, and "An Executive Engineer's Viewpoint of the Accountant's Work and Responsibilities," W. C. Beckjord, vice-president American Light & Traction Company. A. J. Bohl, Milwaukee Electric Railway & Light Company, was elected chairman and J. E. Gray, Wisconsin Power & Light Company, Madison, vice-chairman. About a hundred delegates attended.

DOMINION GOVERNMENT APPROVES WHITE MUD FALLS PERMIT.—The Dominion government has granted a permit for the development of White Mud Falls, in northern Manitoba, to the British Dominions Power Company. The permit is to continue in force for one year, and if at the end of that time the company is prepared to proceed with development, a lease will issue. White Mud Falls is on the Nelson River in northern Manitoba, in the midst of a pulpwood and mining area.

NEW JERSEY PUBLIC SERVICE HIGH-TENSION RIGHT-OF-WAY APPROVED.—The New Jersey Public Utilities Commission has conferred on the Public Service Electric & Gas Company the right to exercise eminent domain against 30 landowners in Morris and Somerset Counties, for the purpose of condemning a right-of-way for its 220-kv. transmission line in conformity with agreements between the Public Service, the Philadelphia Electric and the Pennsylvania Power & Light Company. The commission found that the proposed route is quite direct and passes through territory where such a line would be least objectionable.

OFFICERS OF EMPIRE STATE ASSOCIATION'S SECTIONS.—At the meeting of the Commercial Section of the Empire State Gas and Electric Association held at Niagara Falls on June 20 and 21

(ELECTRICAL WORLD, June 22, page 1302) officers were elected as follows: Chairman, F. M. Houston, Associated Gas & Electric Company, Oneonta; vice-chairman, Merrill E. Skinner, New York Power & Light Corporation, Albany. The Accident Prevention Section of the association, meeting at Watertown on the same days, elected E. R. Dobbin of the Empire Gas & Electric Company, Geneva, chairman, and E. L. Dona of the Northern New York Utilities vice-chairman.

SEATTLE MAYOR WANTS TO TAX MUNICIPAL UTILITIES.—Among recommendations made for a ten-year program of public improvements contained in his annual message to the Seattle City Council, Mayor Frank Edwards has suggested that the light and water departments, the most prosperous of the city's publicly owned utilities, be required to pay annually into the general fund 2 per cent of their gross revenues to assist the taxpayers with their burdens.

INDIANA MERGER VALUATION TO FOLLOW REPRODUCTION-COST METHOD. —A decision has been reached by the Indiana Public Service Commission to employ the reproduction-cost method of valuation in what is known as the "seventy-million-dollar Insull merger," involving the Terre Haute electric and railway properties. Hitherto the work done on this case has been along original-cost lines, but the commission has been led by United States Supreme Court decisions to widen its method of procedure.

REORGANIZATION OF NEW YORK ELECTRICAL EXPOSITION. — Discontinuance of the annual New York Electrical and Industrial Exposition and the substitution in its stead, for this year at least, of the first National Electrical Exposition, to be sponsored by the Electrical Board of Trade of New York and the New York Electrical League, was announced last week. The new exposition will be held in Grand Central Palace from October 7 to October 12, retaining the same site and the same approximate date as the former Electrical Show, and will contain many of the same features.

QUESTION OF DIRECT-CURRENT SUPPLY UP AGAIN IN NEW YORK CITY.—Through its counsel the New York Edison Company promised Chairman Prendergast of the New York Public Service Commission at a recent hearing to supply direct current to building contractors whenever it is possible to do so without further investment on the company's part. The company's determination to supply only alternating current except to consumers who have installed direct-current equipment in buildings brought a protest from building contractors who have purchased such equipment and are unwilling to scrap it at a cost in some cases, they claim, more than $50,000. If an amicable agreement cannot be reached, hearings on the company's alleged obligation to supply direct current to the complainants will be held.

INDIANAPOLIS-BLOOMINGTON (IND.) 66,000-VOLT TRANSMISSION LINE.—Construction of a 66,000-volt transmission line between Indianapolis, Martinsville and Bloomington, Ind., which will carry a greater power supply into the Bloomington stone district, will be started immediately by the Interstate Public Service Company at a cost of approximately $500,000. The total length will be about 50 miles. The construction program includes a new substation southwest of Bloomington, which will make connections with the 33,000-volt lines coming from Edwardsport and Bedford. At Indianapolis the new line will connect with the Lenore substation of the Indiana Electric Corporation, bringing power from the Dresser power plant. That electric corporation will bear the expense of building the transmission line to Martinsville, which is served by the Wabash Valley Electric Company. From Martinsville to Bloomington the expense of the new line will be borne by the Interstate company. All these companies are subsidiaries of the Midland Utility Company.

Coming Meetings

[A complete directory of electrical associations, with their secretaries, is published in the first issue of every volume. For latest list see issue for January 5, page 80.]

Michigan Section, N.E.L.A.—Mackinac Island, July 1-3. Herbert Silvester, Edison Bldg., Ann Arbor, Mich.

American Society of Mechanical Engineers—Salt Lake City, July 1-4. C. W. Rice, 29 West 39th St., New York.

Wisconsin Utilities Association—Electric Section, Wausau, July 18-19. J. N. Cadby, 432 Broadway, Milwaukee.

Camp Co-operation IX — Association Island, Henderson Harbor, N. Y., Aug. 2-6. Society for Electrical Development, 600 Graybar Bldg., 420 Lexington Ave., New York.

International Association of Municipal Electricians—Statler Hotel, Boston, Aug. 20-24. H. N. Lang, box 1864, Orlando, Fla.

International Association of Electrical Inspectors, Western Section — Detroit, Aug. 26-28. W. S. Boyd, 175 W. Jackson Blvd., Chicago. International convention, Vancouver, B. C., Canada, Sept. 9-11. F. D. Weber, P.O. box 745, Portland, Ore.

National Association of Railroad and Utilities Commissioners—Glacier National Park, Mont., Aug. 27-30. J. B. Walker, 270 Madison Ave., New York.

American Institute of Electrical Engineers — Pacific Coast convention, Santa Monica, Calif., Sept. 3-6. F. L. Hutchinson, 33 West 39th St., New York.

Pennsylvania Electric Association—Bedford Springs Hotel, Bedford Springs, Pa., Sept. 4-6. H. A. Buch, Telegraph Building, Harrisburg, Pa.

Rocky Mountain Division, N.E.L.A.—Hotel Colorado, Glenwood Springs, Colo., Sept. 9-11. O. A. Weller, Public Service Co. of Colorado, Denver.

New England Division, N.E.L.A. — Hotel Griswold, New London, Conn., Sept. 9-12. Miss O. A. Bursiel, 20 Providence St., Boston.

Empire State Gas and Electric Association—Saranac Inn, Saranac Lake, N. Y., Sept. 19-20. C. H. B. Chapin, Grand Central Terminal, New York.

Illuminating Engineering Society — Bellevue-Stratford, Philadelphia, Sept. 24-27. A. B. Oday, 29 West 39th St., New York.

American Electric Railway Association —Atlantic City, Sept. 28-30. J. W. Welsh, 292 Madison Ave., New York.

EDUCATED PELICANS HEED UTILITY DANGER SIGNS IN OREGON.—In order to protect the life of the great white pelicans which frequent territory spanned by high-tension lines of the California-Oregon Power Company in southern Oregon, the utility has devised a plan whereby large white boards are suspended from the wires to warn the birds of danger. The pelicans, often attaining a wing spread of twelve feet, have been killed in large numbers while migrating at night and during fogs, and the new detour signs are proving effective in preventing them from crashing into the wires.

NEBRASKA COMPANY OBJECTS TO OPPOSITION FROM IMPORTED PUBLIC OWNERSHIP MEN. — The Iowa-Nebraska Light & Power Company has adopted the policy of refusing to take any part, by officials or financially, in any election called to decide whether a municipality shall sell its plant or purchase energy at wholesale. The company recently offered to purchase the distribution system at Sutton for $40,000, but when public ownership advocates imported Carl E. Thompson of Illinois to address a mass meeting in opposition to the proposal on the eve of the election the company withdrew its offer and the election was thereupon canceled.

BREMERTON DECLARES FOR MUNICIPAL DISTRIBUTION SYSTEM BY SMALL MAJORITY.—By a margin of 49 votes the city of Bremerton, Wash., has at a special election voted in favor of a bond issue of $750,000 for the development of a municipal electric power distribution system. At the present time the city is served by the Puget Sound Power & Light Company under a franchise which expires in 1932 and which gives the city the right to take over the distribution system at a price to be fixed by appraisers. The proceeds of the bond issue will be used either to purchase the present system or to install a new system, the power under either plan to be obtained from the Tacoma municipal plant.

HOLSTON RIVER POWER COMPANY WINS IN TENNESSEE.—Issuance of certificates for the development of the South Fork of the Holston River to the Holston River Power Company and the American Cyanamid Company apparently ends a long contest so far as the Tennessee Public Utilities Commission is concerned, though the rival application from the Tennessee Eastern Electric Company is still pending before

the Federal Power Commission. The Holston company agrees to erect three dams and power plants and supply power to the American Cyanamid Company, which owns 10 per cent of the Holston company's stock and an option on the remaining 90 per cent. Dam No. 1 is to be 79 ft. high and built 6 miles north of Kingsport. It will have a capacity of 24,000 hp. Another is to be erected below the confluence of the South Fork and Watauga Rivers, above Bluff City. It is to be 130 ft. high.

TORNADO DESTROYS PLANT AND LINES IN NEBRASKA.—The municipal light plant at Fairbury, Neb., erected at a cost of $350,000, was almost totally destroyed on June 20 in a tornado that also destroyed or damaged fifteen houses near by. The smokestack fell squarely upon the engine house, demolishing a part of the machinery and so damaging the remainder that little can be salvaged. The tornado covered parts of three counties in the southern part of the state, and long sections of transmission lines belonging to three power companies operating in that territory were blown down.

RATE REDUCTIONS IN SOUTHERN IOWA.—The Iowa Southern Utilities Company, operating in about 150 communities in 25 southern Iowa counties, has made reductions averaging 17 per cent throughout its territory which became effective June 1. In the larger places, where the previous rate was 11 cents for the first 50 kw.-hr., the new tariff is 10 cents for the first 25 kw.-hr., 8 cents for the next 25, 7 cents for the next 50, 6 cents for the next 100 and 4 cents for all above 200 kw.-hr. In 1926 the basic rate was 15 cents, and in six years the company has effected reductions amounting to 44 per cent, officials point out.

INLAND POWER & LIGHT GETS STATE PERMITS FOR LEWIS RIVER SITES.—The Inland Power & Light Company, through state permits just issued, has been empowered to proceed with the development of a hydro-electric power undertaking at two points on the North Fork of the Lewis River in Clark and Cowlitz Counties, Wash. The cost of the project is put at $12,500,000. The company plans to develop power plants on the west slopes of the Cascade Mountains, at Ariel, 12 miles upstream from Woodland, and at Yale, 9 miles east of Ariel. For these two plants appropriations of 7,000 sec.-ft. from the river flow are granted, exclusive of the future needs of two contested sites further upstream at the junctions of Swift and Muddy Creeks with the North Fork of the Lewis River. Concrete dams with a center measurement height of 180 ft. will be erected. The Ariel plant, estimated to cost $7,000,000, will develop 85,000 hp., and the Yale plant, to be known as "the Basket," will develop 95,000 hp. and will cost approximately $5,500,000. The company's head offices are at Portland, Ore., where the bulk of the generated power will be transmitted. The Inland Power & Light already operates a 180,000-hp. plant at White Salmon, in Skamania County, approximately 40 miles southeast of the new plants.

CALIFORNIA TO MAKE STUDY OF HER DAMS.—In accordance with the act passed at the recent session of the California Legislature vesting control and supervision of all dams in the state in the Department of Public Works, all existing dams in California are to be studied within the next three years and either approved or ordered changed to comply with safety requirements. Dams built in the future or alterations made to existing dams which affect their safety must be approved by the state engineer as to plans and specifications before work can be started. Upon request of any owner, the department may appoint a consulting board to report on the safety measures involved, the cost of the report to be paid by owner. The act also provides for supervision over maintenance and operation of all dams, including the taking of any emergency steps necessary to protect life and property.

Recent Court Decisions

POWERS OF OHIO PUBLIC UTILITIES COMMISSION AFFIRMED.—The Supreme Court of Ohio in reviewing a case affecting a freight carrier (Stockton vs. Public Utilities Commission) declared that the commission had not exceeded its powers in modifying a certificate of convenience issued to the plaintiff, since, for good cause shown and after a hearing, it has authority to revoke or modify any certificate issued by it. (166 N.E. 135.)*

BOY INJURED ON PROPERTY NOT SHOWN TO BELONG EXCLUSIVELY TO DEFENDANT NOT A TRESPASSER AS MATTER OF LAW.—Burges vs. Woodward Iron Company was a suit brought to recover damages because of injury received by a boy who climbed a tree and came in contact with a power line maintained by defendant in what was alleged to be an insufficiently guarded way. The Supreme Court of Alabama found that the trial court did not err in refusing a request to charge the jury that if the wire was over private property and high enough not to touch persons rightfully using such property, and if the property was guarded by a fence, a verdict for the defendant should be returned. The court said that the wire might have been wholly or partly over the property of another than the company, and in that case the boy was not as a matter of law a trespasser and whether he was one as a matter of fact was for the jury to decide. (121 So. 399.)

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Commission Rulings

MASSACHUSETTS CITY MAY BUY POWER FROM ELECTRIC COMPANY WITHOUT ASKING COMMISSION'S APPROVAL.—The Massachusetts Public Utilities Department has handed down a decision that a municipal electric light plant which contracts to purchase power is not subject to approval of such contracts by the utility commission. Recently the Turners Falls Power & Electric Company and the city of Westfield petitioned for approval of a contract for the supply of electric power by the company to the municipal plant.

GRANTING ACCESS TO UTILITY'S RECORDS NOT A TRIFLING MATTER.—Issuing orders of mandatory character which require public utilities to grant access to books and records upon application of private individuals is not a matter to be lightly considered by the Oregon Public Service Commission, according to the contention of that body in connection with a request filed by the city of Portland for authority to examine the files of the Portland Electric Power Company. One of the members being absent from the state, the commission refused to pass upon the Portland application until the full board could convene.

INDIANA COMMISSION SUSTAINS REFUSAL TO PUT INDUSTRIAL CUSTOMERS ON MONTHLY DEMAND BASIS.—The petition of fourteen large Indianapolis industrial customers of the Indianapolis Power & Light Company to the Indiana Public Service Commission asking that demand charges be billed on a monthly instead of a yearly basis (ELECTRICAL WORLD, June 1, 1118) has been refused by the commission. Denial was based on the grounds of negligible benefits to the majority of power users in class "D" and increased expenditures and loss in revenues to the company. The order pointed out that the switch to a monthly demand basis would mean a revenue loss of $40,758, according to company and commission figures, and the gain to ten of the petitioners would be but $1,700.

ONLY REGISTERED ENGINEERS ENTITLED TO APPRAISE UTILITIES IN OREGON.—Hereafter the Oregon Public Service Commission will give little weight to any utility valuation report not bearing the signature of an officially registered engineer, this attitude being in accordance with the latest interpretation of a recent opinion rendered by the State Attorney General. Heretofore in Oregon it has been the custom for real estate firms, developing companies and ordinary lawyers to evaluate utility properties, but under the ruling of the state legal department valuations of this character, if made a matter of record, establish *prima facie* evidence that the unprofessional individual or firm performing the work rendered such report in violation of the law which provides that any person engaging in the business of appraising utility property for rate-making purposes must be a registered engineer. It is believed that the opinion will have a tendency to check much of the litigation which in the past arose from controversy involving valuation findings of inexperienced and unqualified appraisers which have been used for the purpose of contesting valuations found by the expert engineers of the regulatory body.

News About Men of the Industry

H. H. Magdsick New President I.E.S.

H. H. Magdsick, who is director of commercial engineering at the National Lamp Works, Cleveland, has been elected national president of the Illuminating Engineering Society for the year 1929-30. He takes office October 1. Mr. Magdsick has been with the National Lamp Works ever since his graduation from the University of Wisconsin, School of Engineering, in 1910. At that time he entered the old Illuminating Engineering Section of the National, where he did his first work in the industry.

It was in 1914 that his work first won wide notice. In that year he designed the floodlighting installation for the Woolworth tower in New York City, which was among the first floodlighting installations on a large building anywhere. At once he became recognized as an illumination expert.

The next year Mr. Magdsick added to his floodlighting laurels by designing the plans and specifications for floodlighting the Statue of Liberty.

He has been director of commercial engineering at the National Lamp Works since 1920, and in that capacity his contributions to research and commercial development in the automotive, electrical advertising, motion picture, theater and rural electrification fields are widely recognized.

His efforts and knowledge of lighting principles and practices led him to Europe in 1923, where he investigated continental lighting conditions and cooperated with various European interests in lighting development. He is on the lecture staff of Case School of Applied Science for commercial lighting and projection.

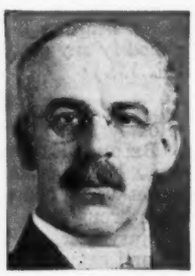
At present Mr. Magdsick is a member of the lighting division of the Society of Automotive Engineers and a member of the motor vehicle lighting division of the Illuminating Engineering Society. Of the latter organization he was for two years chairman of the committee on papers.

H. SPEIGHT has been appointed section engineer in charge of electrochemical and electrometallurgical work in the general engineering department of the Westinghouse Electric & Manufacturing Company. A native of England, Mr. Speight was connected with the British Westinghouse Company, the Manchester Corporation and engaged in electrical contracting work before transferring his interests to America. He first became identified with the Poole Dryer Corporation of Vancouver, British Columbia, and later with the Granby Consolidated Mining, Smelting & Power Company. It was three and one-half years ago that Mr. Speight joined the Westinghouse interests.

W. E. Robertson Resumes Law Practice

William E. Robertson, for years an outstanding figure in the national leadership of the wholesale branch of the electrical industry, has retired from the Robertson Cataract Electric Company, Buffalo, of which he has long been vice-president and general manager. He will resume the practice of law, which he followed many years ago before he entered the electrical industry, and will devote himself to the field of distribution as it involves the problems of industrial companies serving the electrical industry.

As a jobber Mr. Robertson has had an active and distinguished career. As a member of the executive committee of the Electrical Supply Jobbers' Association, now the National Electrical Wholesalers' Association, and as chairman of its Atlantic division he has played a prominent part in the development of the distributing branch of the electrical industry. For years he also served as the representative of the wholesalers on the executive committee of the National Electric Light Association, interpreting the viewpoint of the jobber to the power industry and acting as a liaison to co-ordinate the policies of the two organizations. His vision and courage, his unusual ability as a speaker and his natural qualities of leadership have won him wide influence and a vast circle of friends within all groups of electrical men. To them his retirement will bring genuine regret, for the industry loses one of its most constructive workers for the advancement of electrical progress through organized co-operation.



Mr. Robertson was one of the founders of the Society for Electrical Development and has been active in the promotion of the idea of local leagues. He has been an enthusiastic exponent of better salesmanship and more intelligent merchandising for the development of the domestic uses of electricity as a service to the public. He is one of the trustees of the James H. McGraw awards.

F. A. Merrick Elected Pesident of Westinghouse

F. A. Merrick, an executive well known within the electrical industry, was elected president of the Westinghouse Electric & Manufacturing Company by the board of directors of the company, which met June 26. In announcing the election of Mr. Merrick to the presidency of the company A. W. Robertson, chairman, also stated that the board of directors, while accepting the resignation of E. M. Herr, president since 1911, in order that he might go on an extended vacation, had elected Mr. Herr vice-chairman.

Mr. Merrick advances to the position of president from the position of vice-president and general manager of the Westinghouse Electric & Manufacturing Company. He is a native of New Jersey and received his technical education at Lehigh University. Shortly after his graduation he was employed by the Steel Motors Company, a subsidiary of the Lorain Steel Company, where he was responsible for many important electrical inventions and where he held the position of manager and chief engineer.

On the acquisition of the Steel Motors Company by the Westinghouse company Mr. Merrick entered the Westinghouse organization. He was immediately selected to prepare plans for a plant in Canada and upon the formation of the Canadian Westinghouse Company, Limited, in 1903, was sent to the Dominion as superintendent of the company, subsequently becoming manager of works and later vice-president and general manager. In the World War emergency Mr. Merrick was assigned to organize the operations of the New England Westinghouse Company and after the war Mr. Merrick was located in London, England, for two years as special representative of the Westinghouse Electric International Company, after which he returned to Canada to resume his duties as vice-president and general manager of the Canadian Westinghouse Company, Limited.

The achievements of Mr. Merrick before, during and following the World War won for him in January, 1925, the position of vice-president and general manager of the Westinghouse Electric & Manufacturing Company, with headquarters in East Pittsburgh, Pa. In June, 1925, he was also elected a director of the company. Mr. Merrick in his new executive position will make his headquarters in Pittsburgh.

S. P. MacFadden Heads Nebraska Section of N.E.L.A.

S. P. MacFadden, who was elected president of the Nebraska section of the National Electric Light Association, as announced in the June 8 issue of the ELECTRICAL WORLD, entered the public utility field as a member of the distribution department of the Stone & Webster organization in Beaumont, Tex., in 1917. After spending two years in the army he was appointed assistant to the railway superintendent in Beaumont and subsequently assumed the duties of assistant to the manager of the Eastern Texas Electric Company. Later assignments included the positions of assistant to Luke C. Bradley, district manager of the southwestern district of Stone & Webster, Inc., in Houston and superintendent of the Eastern Texas Electric Company in charge of the Port Arthur properties. On the acquisition of the Western Public Service Company in 1925 by the Stone & Webster interests he was appointed manager of the northern division of the company with headquarters at Scottsbluff, Neb., and when the company was reorganized during the present year Mr. MacFadden was elected vice-president of the new company.

H. B. Smith New President of A.I.E.E.

Harold Babbitt Smith, whose election as president of the American Institute of Electrical Engineers was announced officially this week at the Swampscott convention, is widely known throughout the electrical industry as an educator, engineer and investigator in the field of high-voltage electrical phenomena. Professor Smith has been director of the department of electrical engineering at the Worcester Polytechnic Institute since the fall of 1896 and consulting engineer of the Westinghouse Electric & Manufacturing Company since 1905. His work in the development of high-voltage transformer design and in solid dielectrics has commanded national attention.

Professor Smith was chairman of the International Group Jury of Awards in Electrical Engineering at the St. Louis Exposition in 1904, and from 1917 to 1919 served as an associate member of the U. S. Naval Consulting Board on anti-submarine work. He is a member of the American Society of Mechanical Engineers, fellow of the A.I.E.E., past-vice-president of the latter, former chairman of its committee on sections, member of the Institution of Electrical Engineers, the Society for the Promotion of Engineering Education, and has written extensively for scientific and engineering publications. His recent work includes the development of an engineering research laboratory for ultra-high-voltage investigations at the Worcester Polytechnic Institute, including the design of a transformer of unique characteristics for operation at pressures of the order of 1,000,000 volts. Professor Smith has recently received the honorary degree of doctor of engineering from Purdue University and the Worcester Polytechnic Institute.

J. L. HALEY, vice-president and Capital division manager of the New York Power & Light Corporation, has, in addition to his present assignment, been given executive jurisdiction over the other divisions of the company, the several division managers reporting directly to him. Mr. Haley has had wide experience in utility managership. Before joining the New York Power & Light Corporation, in 1923, he was associated with the H. L. Doherty organization in managerial positions, covering a period of eight years in Colorado, Oklahoma, Connecticut and Mississippi. Since his appointment in 1927 as Capital division manager he has been prominent in civic affairs and at present is chairman of the industrial development committee of the Albany Chamber of Commerce.

O. H. Eschholz New Westinghouse Patent Manager

O. H. Eschholz has been appointed manager of the patent department of the Westinghouse Electric & Manufacturing Company, to succeed O. S. Schairer, who resigned to accept a similar position with the Radio Corporation of America. Mr. Eschholz's headquarters will be at the company's East Pittsburgh works. Born at Holyoke, Mass., Mr. Eschholz was graduated in 1910 from Worcester Polytechnic Institute. He then entered the employ of the Westinghouse company and during the next twelve years was engaged in engineering activity in many branches of the electrical art. Some 50 patents, a number of them of substantial importance, have been issued as a result of this work. He has a wide reputation in electric arc welding, during the war having participated in the work of the welding committee of the Emergency Fleet Corporation. In 1923 he took an executive position with a chemical company, later becoming production engineer for the Standard Gauge Steel Company, Beaver Falls, Pa. He returned to the Westinghouse company in April, 1924, and began work in the patent department. Since then he has engaged in substantially every phase of patent work, devoting much of his time to the stimulation of research and invention on new and desirable lines.

Obituary

OLIVER AMES, senior member of the board of directors of the General Electric Company, died at his home in North Easton, Mass., June 18. Mr. Ames had been a member of the board since 1893, being elected at that time to fill the vacancy caused by the death of his father, who previous to the formation of the General Electric Company was a director of the Thomson-Houston Company. Mr. Ames also served on the directorate of the Edison Electric Illuminating Company of Boston. He was 65 years of age.

GEORGE W. CONOVER, inventor of the Conover electric dishwasher and for many years identified with the electric supply business in Chicago, died June 10. He joined the old Electrical Supply Company in 1885 or 1886, when Franklin S. Terry was manager. Later the name of the organization was changed to the Ansonia Electric Company. Mr. Conover was purchasing agent for many years. In the panic of 1893 the company was forced to make an assignment, but due to the financial condition of the country it was impossible to reorganize and the stock was sold out by the assignee.

WILLIAM O. WINSTON, JR., vice-president and director of Winston Brothers Company, Minneapolis, who had been in Seattle, Wash., for the past two years directing construction of the municipal power dam there, died June 18 in the coast city after a short illness. Following graduation from Williams College in 1908, Mr. Winston matriculated at the college of mechanical and electrical engineering at Cornell University. He completed his studies there in 1911 and entered the field of engineering work, becoming a member of the firm of which his father was president. At the time of his death he was in charge of the construction of the Diablo Dam on the Skagit River, a unit in the hydro-electric development of the city of Seattle. Mr. Winston was 43 years of age.

W. G. DUNCAN of Greenville, Ky., a pioneer in coal mining and power operations in the western Kentucky coal fields, died at his home in Greenville, Ky., June 10, following an illness of several months. Mr. Duncan, head of the W. G. Duncan Coal Company, with mines at Graham and Luzerne, during the war period erected a 5,000-kw. generating plant. At about the same time the St. Bernard Coal Company erected a plant of the same size, and later these plants were leased and subsequently sold to the Kentucky Utilities Company. They became important units in the generating and distributing systems of this company, which proceeded to build transmission lines and connect up other generating units, which today supply a large section of western Kentucky with power and light.

Financial and Statistical News

A MUCH SMALLER VOLUME of trading is being done by the overworked securities markets this week. Ten per cent money, however, has not discouraged buying. The majority of operations are apparently on the bull side.

——A FEATURE OF THE UTILITY STOCKS is North American common, which reached a new high of 146. The company earned $4.68 per share last year and its operations this year to date show a very satisfactory growth. American Gas & Electric and Electric Investors are also strong points again this week.

——MERGER RUMORS HAVE SUBSIDED for the moment, although additional properties are mentioned in connection with the big Eastern utilities consolidation and a tie-up of Pacific Coast properties is also talked of.

Stone & Webster Forms $100,000,000 Corporation

Stone & Webster, Inc., which for 40 years has played a prominent part in the development of the public utility properties throughout the country, has just announced the formation of a $100,000,000 corporation in which the public will have a 40 per cent participation. The new organization will have the same name, Stone & Webster, Inc., as its predecessor, but it is to be a Delaware corporation, whereas the old company was a Massachusetts company. Approximately $57,500,000 of new capital funds will be added to the enterprise, of which $40,000,000 will be derived from the sale of shares shortly to be offered to the public, and the balance will represent securities now held by Stone & Webster, Inc., which are to be turned over to the new organization.

The business of the new company will continue under the same management, but the directorate will be increased to include Albert H. Wiggin, chairman of the board of the Chase National Bank; W. Cameron Forbes, formerly Governor-General of the Philippines; Joseph P. Grace, chairman of the board of W. R. Grace & Company; Herbert L. Pratt, chairman of the board of the Standard Oil Company of New York, and Eliot Wadsworth, formerly Assistant Secretary of the Treasury. The majority or all the stock of the following companies is to be owned by Stone & Webster, Inc., Stone & Webster Engineering Corporation, Stone & Webster and Blodget, Inc., Stone & Webster Service Corporation, Stone & Webster Associates Corporation, Stone & Webster Investment Corporation and Stone & Webster Realty Corporation.

Large Energy Output Apparently Continuing

Suggestive of probable continued gains in other parts of the country also, for which no information is yet available, are the statements of recent weekly output reported by the subsidiaries of the American Gas & Electric Company. These show gains of 21, 17 and 21 per cent for the weeks ended June 1, 8 and 15, respectively, over the corresponding periods last year. The reported figures are 70,032,307, 73,497,338 and 74,528,435 kw.-hr.

Voting Trust Formed by Consolidated of Baltimore

To insure permanence of its present management rather than being drawn into one of the large systems is the apparent object on the part of directors of the Consolidated Gas, Electric Light & Power Company of Baltimore in forming a voting trust for the company's stock. Directors are reported to have stated the purpose was "to avoid any risk of change in management through the manipulation of small minority stock interests to the injury of the unorganized and inactive majority stockholders."

A spectacular upward movement of the company's common stock was checked last week by a denial on the part of officers that the United Corporation was acquiring a substantial minority interest. Quotations rose suddenly from around $108 to about $160, later receding close to the old level in fairly active trading.

Utility Companies Make Application to List Stocks

Shares of the United Gas Improvement Company, which for many years have been listed on the New York Curb, will be transferred to the big board if a listing application now pending is approved. The company's application calls for 20,324,835 shares of no-par common stock and 508,120 shares of no-par cumulative preferred. Aplication has also been made to the Stock Exchange to list 1,045,000 shares of no-par class A stock of the International Hydro-Electric System, a subsidiary of the International Paper & Power Company. Among the other recent applications are the following: General Public Service Corporation, 595,772 shares of common stock without par value already authorized; North American Company, 131,378 no-par common shares.

New Capital Issues

New England Public Service Company Preferred Stock.

Amount, 40,000 shares.
Price, $97 and accrued dividends to yield over 6.18 per cent.
Feature, convertible into common stock.

New England Public Service Company is a part of the Middle West Utilities system and the operating companies and their subsidiaries now serve 553 industrial and farming communities with an estimated total population of 941,810 in Maine, New Hampshire and Vermont. Plants of the subsidiaries have a total generating capacity of 204,501 kw., of which over 69 per cent is hydro-electric. The company has no funded debt and for the year ended April 30, 1929, the earnings available for dividends on all classes of preferred stock were, after depreciation, over 2.51 times the maximum annual dividend requirements on the total preferred stock outstanding. Unless called for redemption, each share may be exchanged up to and including July 2, 1934, for three shares of the company's common stock, or for one share of preferred, $6 dividend series. After the above date the common stock exchange privilege expires. During the five years ended July 2, 1934, no split-up of the common stock can be made after the present financing is completed, and no dividends payable in stock are to be declared on the common except out of earned surplus. The redemption price is $105 and accrued dividends. No additional convertible preferred stock can be issued, unless during twelve months ending within 60 days prior to such issue the net income after deducting dividends on prior lien preferred stock shall be at least 1.75 times the preferred dividend requirements, except exchanged preferred stock and outstanding convertible preferred. No additional class of stock having preference over or equal rank with the convertible preferred may be created without a two-thirds vote of the holders of the convertible preferred.

General Water Works & Electric Corporation Common Stock, Class A.

Amount, 110,000 shares.
Price, $26.75 per share, flat.
Purpose, acquisition of additional subsidiaries, to reimburse in connection with additions and betterments to its present subsidiaries and for other corporate purposes.

General Water Works & Electric Corporation through subsidiary companies renders electric light, power,

water, gas and other services in 172 communities in Texas, Louisiana, Oklahoma, Kentucky, New Mexico, Pennsylvania, Idaho, Indiana and other states. The combined population of the territory served is estimated at 400,000 and the total number of consumers is approximately 61,700.

El Paso Electric Company First Mortgage Gold Bonds.

Amount, $4,000,000.
Price, $95 and interest, to yield 5.40 per cent.
Date of maturity, 1950.

El Paso Electric Company, operating in Texas and the rural sections along its transmission lines, which extend a distance of approximately 150 miles along the Rio Grande, is under the direction of Stone & Webster, Inc. These 5 per cent, series A, bonds are dated June 1, 1925, and mature June 1, 1950. They, together with the series A bonds heretofore issued, making the amount presently to be outstanding $8,000,000, constitute the company's only funded debt, and will be secured by a direct first mortgage on all of the fixed public utility property. Proceeds from the sale of the issue will be used to retire the present floating debt of the company and to finance the major portion of the company's construction program, the principal items of which are the construction of the new power station with its connecting transmission system, installation of equipment in the present power station for the utilization of natural gas as fuel, and the construction of a new international bridge.

COMMONWEALTH POWER ELECTRICITY CONSUMPTION CONTINUES TO INCREASE. —Activity of general business in the territory served by the Commonwealth Power Corporation system is reflected in substantial increases in the consumption of electricity. Sales of electricity in May totaled 172,086,202 kw.-hr., as compared with 144,427,920 kw.-hr. in May last year, an increase of 19.15 per cent. For the first five months of 1929 electric sales were 842,562,316 kw.-hr., as compared with 738,599,947 kw.-hr. for the first five months of last year, a gain of 14.08 per cent. For the twelve months ended May 31, 1929, electric sales were 1,916,443,050 kw.-hr., as compared with 1,660,876,088 kw.-hr. for the twelve months of last year, a gain of 15.39 per cent.

April's Unusual Central Station Record

Revenue rises 9.4 per cent to $167,900,000. Equals that of March. Seasonal decline absent. Output almost 7,500,000,000 kw.-hr., up 16.7 per cent

THAT April operations of electric light and power companies had not only continued the gains of previous months, compared with the early part of 1928, but had surpassed them seemed probable a number of weeks ago when the activities of a few individual companies became known. What was then surmised has now been confirmed by country-wide statistics collected by the U. S. Geological Survey and the ELECTRICAL WORLD.

Energy output amounted to 7,499,416,000 kw-hr., exceeding that of April, 1928, by nearly 1,075,000,000 kw.-hr., or 16.7 per cent. Revenue, $167,900,000, increased correspondingly by $14,700,000, or 9.4 per cent, and operating expenses were $70,400,000, against $64,100,000 a year ago. The revenue equaled that of March and the energy output decreased but slightly, the usual seasonal decline failing to occur. These figures are for the entire industry; where reports are missing estimates have been used.

The average daily output, 250,000,000 kw.-hr. materially exceeded that of March and barely missed the record of 251,000,000 kw.-hr. attained in January and February. It far overshot the estimated normal of 235,000,000 based on the past five years' growth. This unusual situation can be ascribed only to the marked gain in industrial activity compared with the early part of 1928, and is in turn strong evidence that the gain was general, because electrical energy enters into virtually every manufactured product.

The revenue, which had been closely following the normal curve for a number of months, as is evident from the chart, but which fell somewhat below it in March, rose sufficiently in April to come just up to the computed value, averaging $5,600,000 a day.

Water power supplied nearly 43 per cent of the total output; the average daily production from this source broke all previous records. The rise, however, was only 7.6 per cent over the output

Agricultural Areas Join Industrial in Upward Sweep

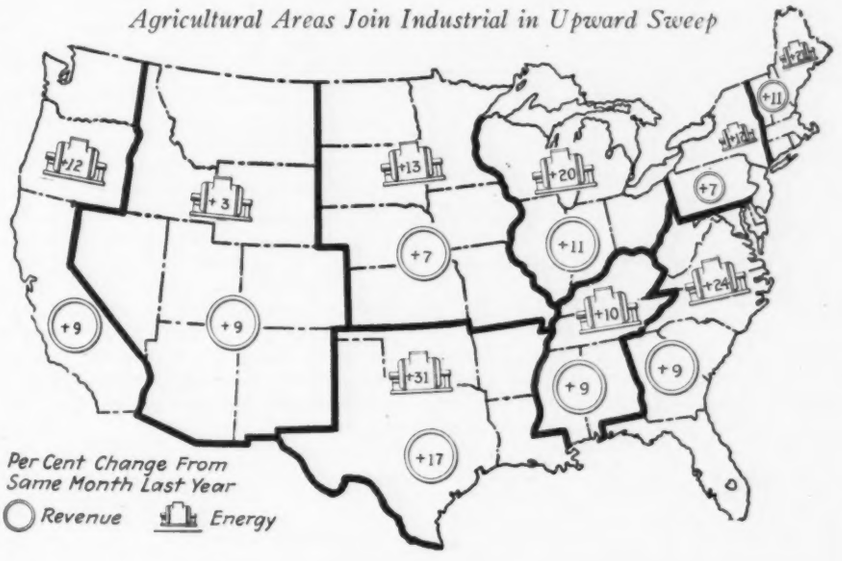


Table I—Central-Station Financial Operations in the United States

Compared with Corresponding Month of Previous Year

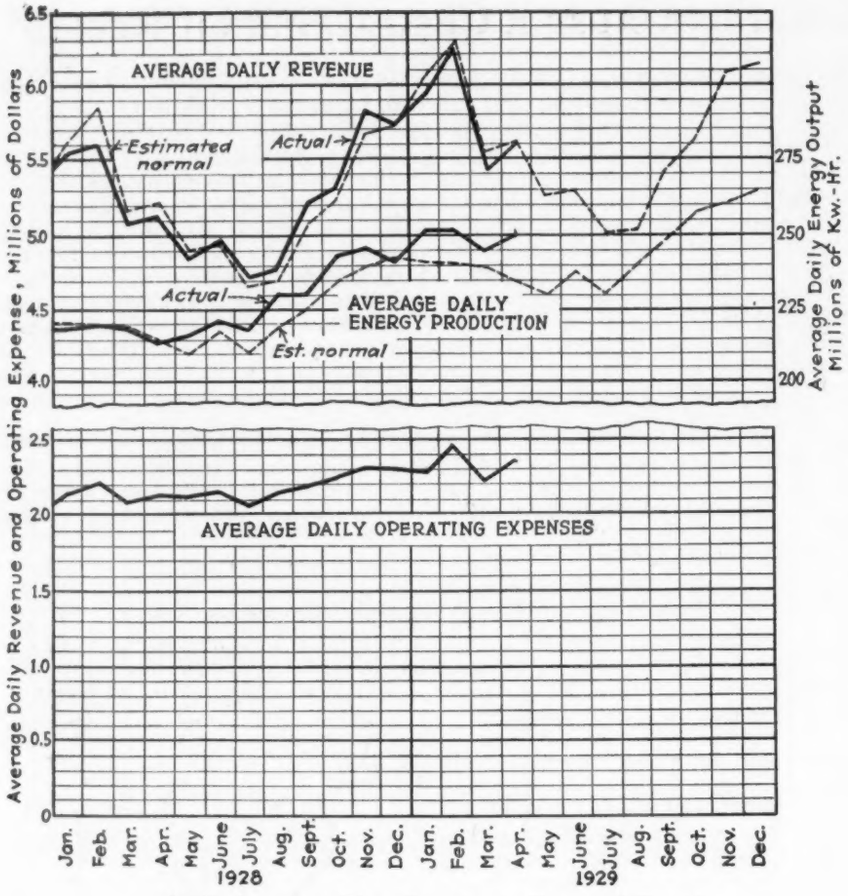
Month	Total Gross Revenue from Sale of Energy*			Total Operating and Maintenance Expense†		
	1929 Thousands	1928 Thousands	Per Cent Inc.	1929 Thousands	1928 Thousands	Per Cent Inc.
January	$184,200	$170,000	+8.2	$71,900	$66,700	+7.8
February	174,300	161,300	+8.0	69,100	64,200	+7.5
March	167,700	155,700	+7.6	69,100	64,700	+6.8
April	167,900	153,200	+9.4	70,400	64,100	+9.9

Table II—Central-Station Fuel Consumption in the United States‡

Compared with Corresponding Month of Previous Year

Month 1929	Coal		Oil		Gas	
	Short Tons	Per Cent Increase	Barrels	Per Cent Increase	Thousands Cubic Feet	Per Cent Increase
January	3,796,778	+14.3	909,085	+62.0	7,923,161	+60.0
February	3,381,668	+ 8.3	834,386	+60.0	7,164,889	+46.4
March	3,265,118	+ 4.6	697,182	+19.3	8,092,601	+44.5
April	3,136,070	+10.7	611,208	+20.5	7,789,490	+47.0

*Aggregate gross revenue from consumers and from other utilities for energy for resale, involving a certain amount of duplication.
†Do not include interest, taxes, depreciation or sinking fund, with some unavoidable exceptions. ‡As collected by U. S. Geological Survey.



April Averages Rise, Counter to Seasonal Trend

of April, 1928. The major part of the increase had to be generated in fuel-burning plants. These produced 4,294,178,000 kw.-hr., approximately 884,000,000 kw.-hr. less than in the peak month, January, but 701,000,000 more than the production a year ago. The latter is equivalent to an increase of 19.5 per cent.

Fuel consumption was greater, but not proportionately so—evidence of further progress in thermal plant efficiency. Relatively more oil and notably more gas are being consumed than were used in the early part of 1928.

Regionally, a conspicuous showing is made by two of the country's chief industrial areas. New England stands out with unusual gains over the corresponding month last year—21 per cent in output and 10 per cent in revenue. A similar showing is made by the East North Central division—20 per cent larger output and 11 per cent more revenue. The 24 per cent increase in energy generated in the South Atlantic states is noteworthy, though the fact should not be overlooked that it is partly due to new hydro capacity put into operation during the year. The change in revenue was smaller, being close to the country-wide average.

The Southwest continues its remarkable march, with 31 per cent more energy generated and 17 per cent more revenue. The West North Central states, also, have made an unusual spurt. In the great agricultural section a rate of growth equal to that in the manufacturing centers is not generally to be expected. The reported 13 per cent increase in kilowatt-hours and 7 per cent in earnings is exceptional. On the Coast, favored region of water power, the rapidly mounting operation of fuel-using plants deserves notice.

Table III—Energy Output of Central Stations in the United States

Compared with Corresponding Month of Previous Year

Month 1929	Generated, Thousands of Kw.-Hr.*						Purchased for Resale	
	Total		Hydro		Fuel			
	Generated	Per Cent Inc.	Generated	Per Cent Inc.	Generated	Per Cent Inc.	Thous. Kw.-Hr.	Per Cent Inc.
January	7,803,765	+15.2	2,625,408	+ 0.6	5,178,357	+24.5	1,260,000	0
February	7,046,042	+10.0	2,390,320	— 2.9	4,655,722	+18.1	1,200,000	0
March	7,602,038	+12.3	3,089,728	+12.8	4,512,310	+12.0	1,320,000	+5.0
April	7,499,416	+16.7	3,205,238	+ 7.6	4,294,178	+19.5	1,310,000	+7.5

Table IV—Regional Operations, Revenue and Energy Output in April, 1929

Compared with Corresponding Month of Previous Year

Region	Revenue		Energy Generated, Thousands of Kw.-Hr.*					
			Total		Hydro		Fuel	
	Thousands of Dollars	Per Cent Inc.	Generated	Per Cent Inc.	Generated	Per Cent Inc.	Generated	Per Cent Inc.
United States	167,900	+ 9.4	7,499,416	+16.7	3,205,238	+ 7.6	4,294,178	+19.5
New England	16,200	+10.5	485,223	+21.5	236,596	+21.7	248,627	+21.2
Middle Atlantic	43,250	+ 7.1	1,753,352	+12.1	610,603	+ 8.2	1,142,749	+14.3
East North Central	43,090	+11.1	1,909,768	+20.3	268,803	+10.2	1,640,965	+22.0
West North Central	12,850	+ 7.1	406,089	+13.1	132,133	— 0.7	273,956	+21.2
South Atlantic	18,950	+ 8.8	1,033,920	+24.5	660,513	+40.1	373,407	+ 1.3
East South Central	5,620	+ 8.6	270,388	+ 9.9	215,152	+11.1	55,236	+ 1.6
West South Central	8,490	+17.0	375,791	+31.0	8,388	+32.6	367,403	+30.9
Mountain	4,100	+ 9.0	306,892	+ 3.1	267,533	— 2.1	39,359	+28.2
Pacific	14,450	+ 8.8	957,993	+12.2	805,517	+ 6.0	152,476	+61.7

*As collected by U. S. Geological Survey.

AMERICAN WATER WORKS & ELECTRIC DECLARES SPECIAL STOCK DIVIDEND. — Directors of the American Water Works & Electric Company, Inc., have declared a special stock dividend of 10 per cent on the common stock, payable July 11 to holders of record July 1. The company is now paying dividends on this issue at the rate of 25 cents per share quarterly in cash and 1/40 of a share semi-annually in stock. The company also declared the regular quarterly dividend of $1.50 per share on the $6 series first preferred stock, payable October 1 to holders of record September 12.

COMMONWEALTH & SOUTHERN CORPORATION DECLARES INITIAL DIVIDEND. —The board of directors of the Commonwealth & Southern Corporation at a recent meeting declared a quarterly stock dividend of 1/80 of a share of common stock, distributable September 1, 1929, to holders of common stock of the corporation of record at the close of business August 1, 1929.

COMMONWEALTH POWER ON $4 DIVIDEND BASIS.—Directors of the Commonwealth Power Corporation have declared a quarterly dividend of $1 a share on the common stock and the regular quarterly dividend of 1½ per cent on the 6 per cent preferred stock, payable August 1 to holders of record July 12. From August, 1928, to May, 1929, inclusive, quarterly dividends of 75 cents per share were paid on the common stock, and on May 1 last an extra of $1 per share was also paid.

Business News and Market Conditions

New Record in Equipment Output

THAT the electrical equipment manufacturing plants of the country recorded a new high rate of productive activity during May is indicated by reports received by the ELECTRICAL WORLD on the monthly consumption of electrical energy by a large proportion of these plants. The rate of activity during May was 5.8 per cent above April, the previous record month, and 36.1 per cent above May last year. The curtailment of operations which is normally to be expected at this season of the year has been conspicuous for its absence, and in its place has come an increase in monthly operations of 2.5 per cent since the opening of the year. The average rate of production for the first five months of the current year is 22.8 per cent above the same period last year.

May, 1929	163.5
April, 1929	154.6
March, 1929	148.3
February, 1929	151.8
May, 1928	120.1
Average first five months 1929	149.9
Average first five months 1928	122.1

A high rate of operations is being reported by both the large and small electrical manufacturing plants. The small plants reported a gain in operations of 9.7 per cent during May, as compared with April, and were operating on a plane 36.7 per cent above May last year. On the other hand, the larger companies reported an average decrease in operations of 1.9 per cent, but were operating on a plane 35.1 per cent above May last year. It is estimated that the electrical manufacturing plants consumed a total of 89,200,000 kw.-hr. of electrical energy during May.

The index of activity in the electrical manufacturing industry, based upon consumption of electrical energy, stands at 163.5 for May, as compared with 120.1 for May last year. Comparative indexes of productive activity referred to the average activity for the period 1923-25 as 100 and adjusted for number of working days are shown in the accompanying table.

Standards on Flat Iron Cord

At the meeting of the National Electrical Manufacturers' Association at Hot Springs, Va., May 25 and 26 it was unanimously agreed to request an industry conference with a view to securing a separate and distinct Underwriters' Laboratories standard on flat iron cord to reduce hazards.

The heating device manufacturers are agreed that an advance was made when the heater cord standard was set up and adopted, but that this standard, while it seems satisfactory for the general run of heating appliances, particularly table appliances, is very unsatisfactory for flat irons. This is due to the peculiar service of the flat iron requiring constant motion, making the wear and tear much more severe. The results show the effects of excessive heating near the terminal. Obviously every time the cord breaks or wears a real hazard is involved, and there are more flat irons in use than any other group of heating devices—approximately 16,000,000.

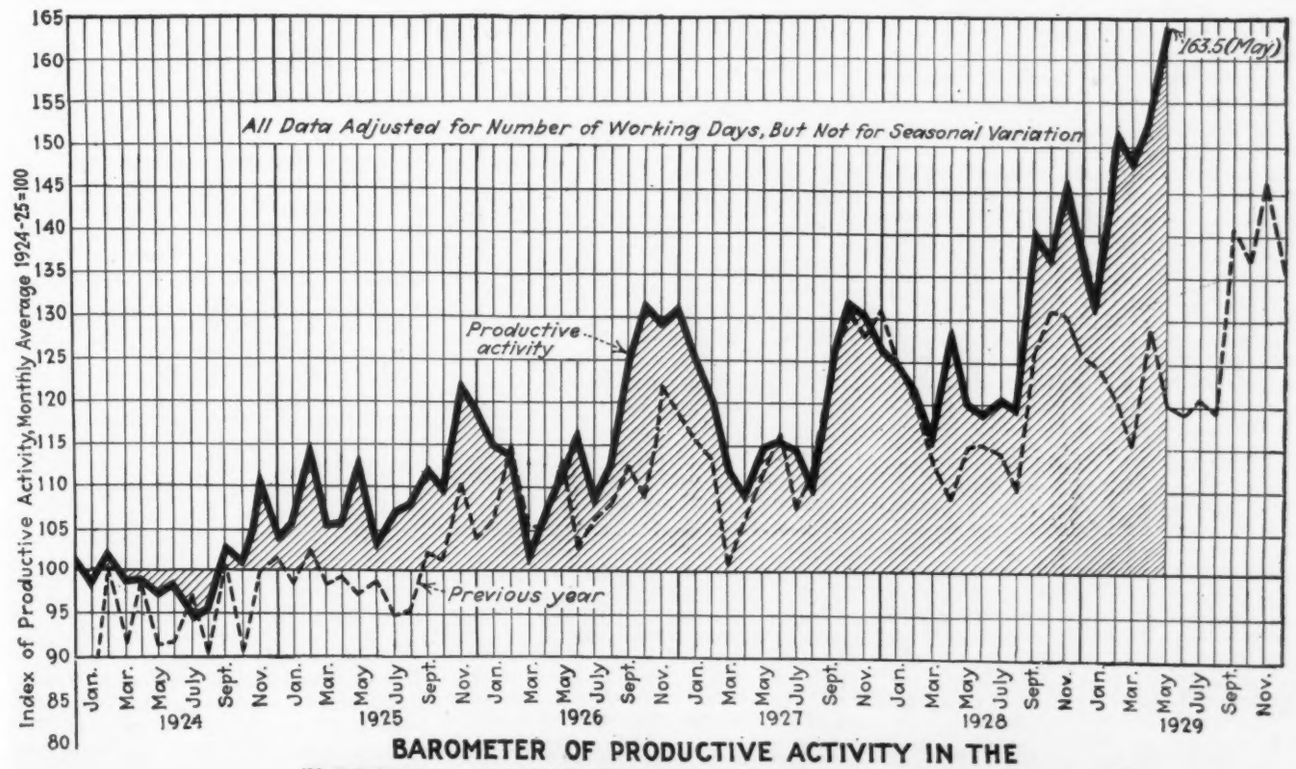
Copper and Lead in Fair Demand

A three months' period of generally quiet metal markets, covering the second quarter of the year, has now been completed, with the belief general that manufacturers have practically exhausted their contracted supplies of metal and that therefore a more active metal market will be witnessed in July. Hand-to-mouth buying is about all that cautious observers expect, however, Since April 1 copper has declined 6 cents.

NEW YORK METAL MARKET PRICES

	June 19, 1929 Cents per Pound	June 26, 1929 Cents per Pound
Copper, electrolytic	18	18
Lead, Am. S. & R. price	7.00	7.00
Antimony	8.875	8.75
Nickel, ingot	35	35
Zinc, spot	7.038	7.075
Tin, Straits	44.625	44.50
Aluminum, 99 per cent	24.30	24.30

Base copper wire price June 26, 1929, 19¼ cents.



BAROMETER OF PRODUCTIVE ACTIVITY IN THE ELECTRICAL MANUFACTURING PLANTS OF THE UNITED STATES

Market Conditions

CURRENT EQUIPMENT business is running about normal, but a seasonal recession is predicted in some sections. In others, indications of summer slackness are entirely lacking up to the present.

——TRANSFORMER EQUIPMENT IS MOVING SATISFACTORILY throughout the Eastern district and inquiries on central-station equipment for forthcoming installations are expanding.

——POWER COMPANY ORDERS ARE COMING in at a satisfactory rate in the Southeast.

——CENTRAL-STATION ORDERS LEAD also in New England, a feature being a large order for disconnecting switches and control equipment.

——DISTRIBUTION AND POLE LINE EQUIPMENT are moving satisfactorily in the Middle West with general business somewhat better.

——CABLE ORDERS FEATURE BUSINESS on the Pacific Coast, while high-tension insulators and distribution transformers are moving in some volume.

MIDDLE WEST

A slight acceleration in general business was noticeable in the Middle West section. While a slight recession in steel mill operation is observed, due to reduced production schedules in the automotive industry, agricultural implement manufacturers continue to absorb large quantities of steel products. Equipment purchasing by the various railroads is generally looked upon as a favorable indication of good business, while car movements indicate a large and diversified demand for all commodities. The utility companies are unusually busy with a large amount of line extension and circuit revision work. Maintenance purchasing is particularly heavy with a comparatively light demand for major apparatus. One interesting order placed was for six substation type water filters, 60 g.p.m., complete with accessories and coagulating tanks. Jobbers' sales are normal. Construction projects are as follows:

The Chicago, Milwaukee, St. Paul & Pacific Railroad Company, Chicago, plans additions to its car repair shops at Milwaukee, Wis., to cost $1,000,000. Detroit, Mich., plans a municipal electric power plant, to cost $100,000. The Gabriel Steel Company, Detroit, will build an addition to cost $75,000. The New Orleans Fruit Company, Flint, Mich., will build a cold storage and refrigerating plant to cost $100,000. The Board of Education, Grand Rapids, Mich., has filed plans for a vocational and technical high school to cost $500,000. The Coca-Cola Company, Chicago, plans a bottling and storage plant to cost $200,000. The Gardner-Denver Company, Chicago, will build an addition to its drill manufacturing plant to cost $90,000. The Shellmar Products Company, Chicago, will build an addition to its glassine paper products factory, to cost $80,000. The F. W. Amend Company, Danville, Ill., will build an addition to its confectionery plant to cost $85,000. The International Harvester Company, Chicago, contemplates a factory branch and distributing plant at East Moline, Ill., to cost $400,000. East Chicago, Ind., has authorized an engineering report for a municipal lighting plant The Mosby Medicine Company, Cincinnati, Ohio, has asked bids for a plant addition to cost $500,000. The Cleveland Automatic Machine Company, Cleveland, plans a plant at Elyria, Ohio, to cost $200,000. The Midland Steel Products Company, Cleveland, plans an addition to cost $175,000. The Empire Steel Company, Mansfield, Ohio, plans an addition to its plant at Niles, Ohio, to cost $200,000. Urbana, Ohio, contemplates a municipal electric light and power plant to cost $400,000. The General Fireproofing Company, Youngstown, Ohio, plans an addition to its metal products plant to cost $250,000. The Mahoning Ice & Fuel Company, Youngstown, Ohio, plans an addition to its plant to cost $45,000. The Ohio Power Company, Newark, Ohio, plans a power substation at Zanesville, Ohio, to cost $100,000. Lakota, N. D., has authorized a bond issue of $30,000, for a municipal electric light and power plant.

ST. LOUIS DISTRICT

The adjustment of labor difficulties has resulted in an increase in the amount of sales in all classes of building in the St. Louis district. Jobbers report that central-station business for June so far has been greater than that of May with a good demand for meters, distribution transformers and pole line equipment. A large local manufacturing company placed an order for three synchronous motor-generator sets of 500 kw. each, two with automatic and one manual control, the total contract amounting to $40,000. The Missouri Public Service Company bought a lot of street car brake compressors costing $20,000. A lot of ten motors of 5 to 250 hp. costing $7,500 was sold to a rock crushing plant, and two motors of 150 and 300 hp. were sold to a lead mining company. Construction projects are as follows:

Eldorado Springs, Mo., plans a municipal electric light and power plant, to cost $40,000. St. Louis, Mo., plans a vocational school to cost $1,500,000. The Voice of St. Louis, Inc., St. Louis, will build a radio broadcasting station to cost $300,000. The Capital Steel & Iron Company, Oklahoma City, Okla., plans a plant to cost $200,000. Nevada, Mo., Ames, Okla., and Celina, Tex., contemplate ornamental lighting systems. Goose Creek, Tex., plans a municipal electric light and power plant to cost $30,000. The Central Power & Light Company, San Antonio, Tex., plans an ornamental lighting system at Harlingen, Tex. The Houston Lighting & Power Company, Houston, Tex., plans a power substation to cost $25,000. The Wofford Syrup Company, Houston, Tex., plans a plant to cost $70,000. The Texas Citrus Fruit Growers' Exchange, Mission, Tex., plans a fruit-packing plant at LaFeria, Tex., to cost $70,000. The Texas Milk Products Company, Marshall, Tex., plans a powder milk plant at Mount Pleasant, Tex., to cost $150,000. The Scobey Fireproof Storage Company, San Antonio, Tex., plans a cold storage and refrigerating plant to cost $400,000. Edwin Harding, Alexandria, La., and associates will build an ice cream plant which will cost $100,000.

PACIFIC COAST

Power company purchases on the Pacific Coast are largely composed of special rubber, lead and paper insulation cables, of which perhaps $100,000 worth of business has been placed in California. Also prominent are two carloads of high-tension insulators and distribution transformers, but all manufacturers of machinery report a very light demand. Hospitals, schools and such large residences as the Vanderlip $100,000 home near Los Angeles and a $60,000 home for Hillsborough comprise most of the new building, with industrial construction now very light, though with much promise, such as a $700,000 warehouse for Honolulu, a $2,000,000 lumber plant for the Beckwith country, the $2,000,000 Ford plant at Long Beach and a $3,000,000 cement plant for Stockton, Calif. Airport and other special lighting equipment is being very briskly solicited with much pioneering, the work being done by manufacturers and wholesalers. The recent business includes a $30,000 order for a Glendale, Calif., airport, a $51,000 street lighting award by Oakland, Calif., a $10,000 award by Salinas, Calif., and additions to the present Niles and Sacramento, Calif., systems. The San Francisco ferry tower will require about $15,000 worth of projector and wiring material. Miscellaneous business includes telephone and power apparatus for the Mare Island navy yard, fire alarm systems for Oroville, Calif.; traffic control cable for Oakland, Calif.; a radio signaling system for the Berkeley police department, and four 400-hp. transformers and other material for the Diamond Springs substation.

Surveys for a 25-mile transmission line from the Nisqually River near the Yelm site of Centralia, Washington's hydro-electric plant, to Centralia are completed and bids for materials will be called for shortly. About the middle of August the city of Centralia, Wash., is expected to award contracts either for two 2,500-kva. or for one 5,000-kva. generator, also for a waterwheel, three 1,667-kva. transformers, switchboards, etc., for the municipal plant. The city of Seattle will take bids soon for a bank of four transformers costing about $20,000 for a substation and also for four 50-hp. motors. The port of Tacoma, Wash., is taking bids for one 250-kva. alternator, one 4-in. pump, one 15-hp. motor and four 5-hp. motors for

a cold storage plant. Permits were granted to the Inland Power & Light Company, Portland, Ore., for a hydro development on the Lewis River, in Washington, involving two plants costing approximately $12,500,000, and to the Washington Electric Company a subsidiary of the Puget Sound Power & Light Company, Seattle, for a 120,000-kw. development on the Columbia River at Rock Island. Construction projects are as follows:

The Axelson Machine Company, Los Angeles, will build an aircraft motor manufacturing plant at Huntington Park, Calif., to cost $100,000. Warner Brothers Studios, Inc., Los Angeles, will build a power plant for motion picture studio service. Monterey, Los Angeles, Richmond, San Francisco, and Sacramento, Calif., plan ornamental lighting systems. The Union Ice Company, San Francisco, plans a precooling plant at Napa, Calif., to cost $25,000. The Western Washington Light & Power Company, Aberdeen, Wash., plans a hydroelectric power plant to cost $3,500,000, with a transmission system. Nalleys Pure Food Products Company, Tacoma, Wash., will build a factory addition to cost $90,000. The Idaho American Phosphate Company, Nampa, Idaho, plans a phosphate mill to cost $90,000. The Mineral County Power System, Hawthorne, Nev., will receive bids until July 7 for equipment for an outdoor substation, with transformers, metering apparatus, etc. Las Vegas, Nev., and Yuma, Ariz., plan ornamental lighting systems.

Southeast

A sustained volume of business is reported for the Southeast. A power company in Georgia ordered $150,000 in large power transformers, $110,000 in oil circuit breakers, $15,000 in pumping equipment and a traveling crane costing $16,000 in connection with a new steam-generating station project. Another central-station order was for creosoted pine poles amounting to $8,400 and $3,700 worth of crossarms. One of the smaller power companies ordered pine poles costing $2,000. Some other central-station purchases were distribution and small power transformers amounting to $8,400, small switching equipment totaling $6,800 and $3,600 in arrester equipment. A bleachery in South Carolina ordered motor and control equipment aggregating $55,000. A hotel in Atlanta, Ga., placed an order for a $20,000 radio amplifying installation, while two small hotels in middle Georgia placed orders each for fans costing $2,000. A $5,000 fan order is in prospect for this week. A cotton mill electrification in Georgia was responsible for a $5,500 switchboard and regulator order that was placed. Construction projects are as follows:

The Hancock Manufacturing Company, New Cumberland, W. Va., will build a steel stamping mill to cost $80,000. The Chicago, Wilmington & Franklin Coal Company, Chicago, plans extensions in its mining properties at Eccles, W. Va., to cost $1,000,000. The Cumberland Falls Hydro Electric Power Company, Cumberland Falls, Ky., plans a hydro-electric power plant to cost $2,000,000. The United States Foil Company, Louisville, Ky., plans a plant to cost $85,000. The Cherokee Oil Company, Knoxville, Tenn., plans an oil storage and distributing plant to cost $50,000. The Interstate Airlines, Inc., Murfreesboro, Tenn., plans a floodlighting system at its airport to cost $150,000. Conover, N. C., plans an ornamental lighting system. The Carolina Power & Light Company, Raleigh, N. C., will build a transmission line from Sanford to Carthage, Mo., to cost $40,000. Birmingham, Ala., plans a floodlighting system and beacon lamps for its municipal airport to cost $400,000. J. N. McDonald, First Bank & Trust Building, Sarasota, Fla., and associates plan a hydro-electric power plant on the Oklawaha River, capacity 16,000 hp., to cost $2,000,000.

Eastern District

The turn of July finds business treading slightly above normal in the Eastern district. Both central stations and industrial interests are sharing in the demand and the next 30 days is expected to bring a seasonal recession in trade. Prime movers are being accorded scant attention. A western Pennsylvania manufacturer has secured a contract for a turbo-generator unit for a municipal installation in Kentucky, totaling $45,000, the order for a condenser going to a maker in the same territory at a price of $13,400. Transformer equipment continues in fair call and inquiries from central stations for forthcoming installations are increasing in volume. A northern New York utility company has contracted with a state maker for transformers, regulators and miscellaneous switchgear to an amount of $100,000. A central station in Indiana has purchased similar equipment from a New York manufacturer, including a synchronous condenser unit, costing $150,000.

Switching apparatus and control equipment have developed a sizable volume of current trade, but inquiries are showing a decline. Motor account gives good summer promise, iron and steel mills continue in the market for heavy-duty units and a number of sizable commitments have been made. Chemical factories are showing an increase in inquiries, with textile mill account likewise advancing. Fractional-horsepower units are in fair call. A record order for electric capacitators for talking machine service has been placed by the Victor Talking Machine Company and the Radio Corporation of America, Camden, N. J., with the General Electric Company, aggregating $1,250,000. A manufacturer of wire and cable reports a steady volume of small order account, covering requirements primarily of central stations and railroads for high-tension installations, both overhead and underground. A metropolitan railroad has placed an order with a New York producer for a quantity of electric air filters to cost $35,000. A maker of electric refrigerators says that demand is holding up excellently, with business exceptionally brisk at the present time for residence and apartment house units. A fine market is also being developed for electric refrigerated water coolers. Construction projects are as follows:

The Superior Fireproof Door & Sash Company, New York, will build a plant to cost $150,000. The Delaware, Lackawanna & Western Railroad Company, New York, will receive bids until July 19 for motors for 141 motor cars, controllers for 282 cars, heaters for 282 cars, and air compressors for 141 cars, in connection with electrification of its suburban lines in New Jersey. The Boyce Thompson Institute for Plant Research, Yonkers, N. Y., plans additions to cost $400,000. The Buffalo City Hospital, Buffalo, N. Y., is asking bids until July 9 for a power plant in connection with proposed institutional buildings, including motors, fans, pumps, etc. The Newport Chemical Works, Inc., Passaic, N. J., plans expansions to cost $600,000. The Kent Garage Investing Corporation, New York, will build an automobile service, repair and garage building at Newark, N. J., to cost $1,000,000. The White Company, Cleveland, Ohio, will build a motor truck factory branch, service and repair plant at Newark, N. J., to cost $200,000. The Prudential Insurance Company, Newark, N. J., will build a printing plant to cost $500,000. Proctor & Schwartz, Inc., Philadelphia, will build an addition to its drying machinery plant to cost $70,000. The Harshaw Chemical Company, Philadelphia, plans a plant to cost $65,000. Schuylkill Haven, Pa., will receive bids until July 8 for a municipal electric plant to cost $150,000. E. L. Myers Company, Washington, is preparing plans for a power plant for the government to cost $500,000. The Bureau of Supplies and Accounts, Navy Department, Washington, will receive bids until July 16 for four cruising and high pressure turbines and spare parts for the Philadelphia and Norfolk navy yards (Schedule 1286.)

New England

Orders for central-station equipment lead in interest in the New England district. Recently a number of switch orders of interest were noted and high-voltage switches for a Western power company amounting to $25,000 were ordered. A large order for disconnecting switches and control amounting to $150,000 is pending and will be placed soon by a New England power company. Small switch and control orders are steady and in good volume. The new substations projected are providing for a considerable amount of new control equipment. Insulator sales are encouraging. Industrial equipment sales have lessened during the past week and small motor sales show little change. Orders for heavy power generating equipment will soon be placed and negotiations for waterwheels for 25,000-kva. generator units for a Maine water power project have been closed.

New construction materials are moving in good volume, while wire, pole and hardware shipments are regular. Fan sales are heavy and wiring devices for new construction are in good demand. Inside, special lighting reflector units are active, with the demand for institutional lighting equipment very encouraging. Electric - power - driven tools and contractors' equipment sales are gaining. Construction projects are as follows:

The United Feldspar Corporation, New York, will make extensions in its mill at West Paris, Me., to cost $70,000.

Activities of the Trade

Westinghouse Receives Order for Power Line Equipment

The Westinghouse Electric & Manufacturing Company announces the securing of a large power line communication order from the Southwestern Gas & Electric Company, Shreveport, La. This order covers five high-power, 250-watt sets which will be installed at Shreveport, La.; Marshall and Mineola, Tex., and Texarkana and Saratoga, Ark. A total of 500 miles of power lines between those points will be used for communication purposes as well as for the transmission of power.

To insure continuity of service past those points where the power lines are opened at certain times or where there are transformer banks four by-pass equipments will be supplied. Another feature of the installation will be the use of tuned resonant line chokes, the use of which gives clear, isolated power line communication channels on the most complex power networks. The system when installed contemplates intercommunication with the power line communication equipment on the Arkansas Power & Light Company system, which now has seven Westinghouse sets installed.

THE NORTHWESTERN MANUFACTURING COMPANY, Milwaukee, manufacturer of motors, dynamos and special electrical machinery, announces the appointment of the Welding Engineering Company, 1154 41st Street, Milwaukee, as its Wisconsin and northern Illinois representative.

THE PREMIER VACUUM CLEANER COMPANY, Cleveland, announces the appointment of Harry C. Hahn as sales manager of its company. In 1925 Mr. Hahn joined the sales department of the company and in 1928 he was promoted to the position of assistant sales manager, with increased duties and responsibility for trade relations.

THE AMERICAN ENGINEERING COMPANY, Philadelphia, manufacturer of the "Taylor" stoker, "Lo-Hed" electric hoists, etc., has received an order from the Chesapeake & Ohio Railway Company for 47 hoists, consisting of 31 1-ton hoists and sixteen 2-ton hoists.

THE COPPERWELD STEEL COMPANY, Glassport, Pa., has formed a southeastern district, comprising Georgia, Alabama, Tennessee, Florida, Mississippi and part of Louisiana, with P. A. Terrell in charge as district manager. The office of this district is located in the American Traders Bank Building, Birmingham, Ala.

THE WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY has received an order from the Public Service Electric & Gas Company, Newark, N. J., for an oil-immersed electric circuit breaker. It will be installed at the Roseland switching station of the Public Service company, on the new Roseland-Bushkill high-tension transmission line now under construction, and will be put into operation about October 1. The apparatus will stand 25½ ft. high and will be 45 ft. long. The three poles of the switch will be immersed in 22,000 gal. of oil.

Rubber Companies Merge

An announcement has been made by A. F. Townsend, president of the Manhattan Rubber Manufacturing Company, New York City, that a merger of the Manhattan Rubber Manufacturing Company, Passaic, N. J.; the Raybestos Company, Bridgeport, Conn., and the U. S. Asbestos Company, Manheim, Pa., has been consummated through the banking firm of Hayden, Stone & Company and the Equitable Trust Company of New York.

A company will be formed which will take over the stock of these three companies; it will be organized along the lines of the U. S. Steel and General Motors Companies. The operations of each of the individual companies will be conducted by their present officers and there will be no changes in the personnel or management of the individual units.

The Manhattan Rubber Manufacturing Company has for a long time been a large manufacturer of mechanical rubber goods, brake linings, clutch facings and other accessories for the automobile industry.

The Raybestos Company and the U. S. Asbestos Company are also outstanding manufacturers in similar lines with the exception of mechanical rubber goods. The combined output of these three companies as far as brake lining and clutch facings are concerned will be the largest individual unit in the business.

THE AUTOMATIC ELECTRIC HEATER COMPANY, 1706 Race Street, Philadelphia, announces that Allan C. Drew, identified with electrical appliances and heating devices for the past fourteen years, has joined its organization. Mr. Drew will have full charge of sales with the title of vice-president and sales manager for the electric water heater division of the company.

THE NORTH AMERICAN REFRACTORIES COMPANY, National City Bank Building, Cleveland, announces the consolidation of the following companies: Ashland Fire Brick Company, Ashland, Ky.; Crescent Refractories Company, Curwensville, Pa.; Dover Fire Brick Company, Cleveland; Elk Fire Brick Company, St. Mary's, Pa.; the Farber Fire Brick Company, Farber, Mo., and Queens Run Refractories Company, Lock Haven, Pa.

British Electrical Trades in Combination

Rumors of further amalgamations in the electrical manufacturing industry derive some measure of confirmation from the remarks made by Howard C. Levis, chairman of the Associated Electrical Industries, at the annual meeting of the company which was recently held. The Associated Electrical Industries is a combine which was formed last year to take over the Metropolitan-Vickers, British Thomson-Houston, Edison Swan and Ferguson Pailin. The steps already taken to merge the interests of these companies, he said, could be regarded only as the beginning of what should be done if the electrical industry in England was to develop successfully, and every effort would be made by those in control of the industry to secure co-operative arrangements which would give an adequate return. Mr. Levis also indicated the directions in which economies would accrue from the merger in engineering, production, research, selling, purchasing and general co-ordination.

RAINBOW LIGHT, INC., an operating subsidiary of Rainbow Luminous Products, Inc., 120 Broadway, New York City, manufacturer of luminous tube-lighting apparatus, is expanding the facilities of its Boston factory to provide a complete luminous tube service to the New England territory. Miles Pennybacker will be in charge of the company's New England operations.

THE SWARTZBAUGH MANUFACTURING COMPANY, Toledo, Ohio, manufacturer of "Everhot" electric appliances, announces that Edwin Moran has been appointed direct factory representative for its company in the territory consisting of metropolitan New York, New Jersey and eastern Pennsylvania. Mr. Moran will be in charge of the company's New York City office at Room 209, Fifth Avenue Building, 200 Fifth Avenue.

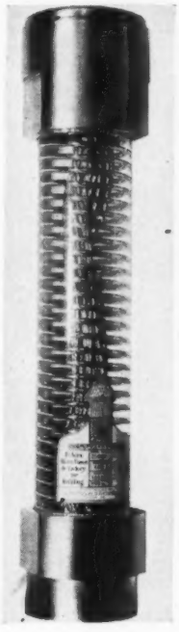
THE GENERAL REFRACTORIES COMPANY, 104 South Sixteenth Street, Philadelphia, has changed the address of its Cleveland office to 1126 Leader Building. The company's Buffalo, N. Y., address also has been changed to 1210 Genesee Building.

THE SUNDH ELECTRIC COMPANY, INC., Newark, N. J., manufacturer of electric control apparatus, announces that Gordon H. Gildersleeve, 439 Terminal Tower Building, Cleveland, has been appointed as its representative to take care of northern Ohio.

THE LINCOLN ELECTRIC COMPANY, Cleveland, manufacturer of "Stable-Arc" welders and "Linc-Weld" motors, announces the appointment of B. W. Brown as its district sales representative with headquarters at Milwaukee, Wis. G. O. Forseth, formerly a sales representative at Detroit, has been made district sales representative with headquarters at Minneapolis, Minn.

New Equipment Available

Improvement in S & C High-Voltage Fuse



Extensive improvements have been made in the S & C high-voltage fuse used on systems of 2,300 to 132,000 volts and manufactured by Schweitzer & Conrad, Inc., Chicago. A new arc-extinguishing liquid has been developed for which the manufacturer claims greater current-interrupting properties and higher dielectric strength.

In this fuse a vent is employed for relieving excess pressure if necessary when the fuse blows. This consists of a cap secured to the top of the fuse in such a manner that it will come off should the internal pressure reach a certain predetermined value. A new form of cap with crowned surface is provided, the operation of which, it is stated, will not be obstructed by deposits on the metal due to atmospheric action.

The internal parts have also been redesigned and arranged in such a way that the spring which separates the terminals when the fuse blows will travel at a greater speed. Also, these parts are improved to secure better voltage stress distribution.

The manufacturer states that all of these improvements combined give the S & C fuse considerably increased interrupting capacity. In three-phase tests made on the 44,000-volt system currents of such values were interrupted repeatedly to show that the three-phase interrupting capacity of the fuse was in excess of 500,000 kva.

Pyrometer for Molten Type Metal

A new type FD pyrometer for indication of the temperature of molten type metal as used with various kinds of type-casting machines is announced by the Roller Smith Company, New York. The outfit consists of a pyrometer 4 in. in diameter, a thermocouple and leads.

As compared with glass tube thermometers many points of superiority are claimed. A few of these are: (1) Readings can be taken from any position and from considerable distances; (2) there is no breakage and the FD pyrometer is strong, sturdy and with reasonable care will give good results for long periods; (3) it is not damaged by abnormal temperatures; (4) the range is from zero to 1,200 deg. F.

Heavy-Duty Variable Resistor for Sound Movie

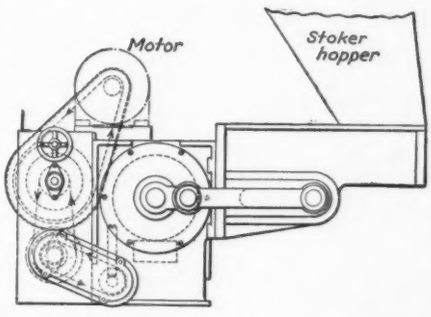
To meet the demand for a stepless heavy-duty variable resistor to control line voltage, plate voltage, grid bias and other functions in the electrical end of sound movies the Clarostat Manufacturing Company, Brooklyn, N. Y., has introduced a super-power clarostat. This device is said to provide precise resistance settings over a wide range because of its stepless principle. With a current handling capacity of 250 watts it is available for heavy-duty applications. It maintains any resistance value without fluctuation and, it is claimed, does not introduce variations or noises in any circuit in which it may be applied.

Electric Motor Drive for Types E and K Stokers

An electric motor drive for types E and K under-feed stokers manufactured by the Combustion Engineering Corporation of New York, which are usually steam-driven, is announced by that company. The new drive is applicable to either of these stokers and may be used wherever the steam drive is impractical, as for instance where the operating steam pressure is below 60 lb. per square inch.

The electric drive consists of a double worm gear reduction unit and a Reeves variable speed transmission unit. The gear case assembly is very compact. All parts are fully incased yet readily accessible.

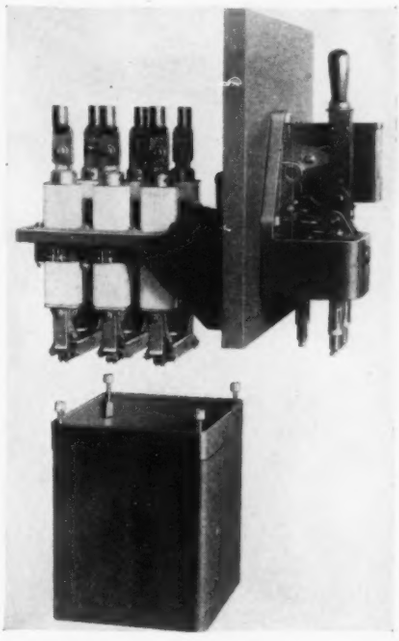
The Reeves mechanism is driven by



a silent chain from the motor. On the opposite side is the hand wheel, conveniently located for adjusting the speed changes. The ratio of speed change is from 1 to 8, which is ample for the usual range of combustion rate. A pointer device is mounted for indicating the relative speed. When a steam pressure regulator is used to secure automatic control of the stoker speed a lever is substituted for the hand wheel control of the Reeves drive. The power required to drive either a type E or type K stoker is quite low.

Type O Oil Switches and Circuit Breakers

A new type of oil switch made in capacities from 200 to 2,000 amp., from 2,500 to 15,000 volts and with interrupting capacity from 20,000 to 40,000 kva. is announced by the Roller-Smith Company, New York City. The switches are made as two-pole and



three-pole devices, automatic and non-automatic, single and double throw for switchboard, wall and cell mounting, for hand operation, normal and remote control, and electrical operation.

A few of the outstanding characteristics claimed for this new line of oil switches are, first, continuous laminated conductor from terminal to moving member; second, self-aligning contact of drawn copper gives a strong, highly conductive, light-moving, high-speed member; third, arcing tips are of large volume of copper and are designed especially to utilize electromagnetic stresses to increase contact pressures; fourth, the entire mechanism is completely inclosed and is the straight-line type; fifth, conductors are rigidly clamped in heavy wet process porcelain insulators; sixth, the frame is a heavy casting internally ribbed and dome-shaped for strength; seventh, the heavy welded tank is supported on a frame by large short bolts; eighth, a double flange for the tank seat permits free venting between tank and frame, with great reduction in tendency to oil throw; ninth, the wooden contact rod is of specially treated material in one piece; tenth, the tank is lined with insulation material especially selected to resist the burning of the arc; eleventh, the volumes for oil and gas expansion are exceptionally large.

Electrical Patents

Announced by U. S. Patent Office

(Issued June 11, 1929)

1,717,285. ELECTRIC CIRCUIT SWITCH; H. W. Vickery, Lynn, Mass. App. filed May 15, 1926.

1,717,287. INSULATING ROD; H. W. H. Warren, Coventry, and R. Newbound, Rugby, England. App. filed June 21, 1927.

1,717,289. DYNAMO-ELECTRIC MACHINE; W. Weiler, Berlin-Niederschonhausen Germary. App. filed Dec. 17, 1927.

1,717,290. INDUCTION-MOTOR-CONTROL SYSTEM; W. Weiler, Niederschonhausen, Germany. App. filed Aug. 22, 1928.

1,717,292. LIGHTNING ARRESTER; L. H. Whitney, Pittsfield, Mass. App. filed June 9, 1927.

1,717,293. ELECTRICAL REGULATOR; F. H. Winter, Schenectady, N. Y. App. filed Oct. 31, 1927.

1,717,299. ELECTRICAL SYSTEM; S. Aoki, Hiratsuka, Japan. App. filed May 17, 1927.

1,717,302. PRIME-MOVER PLANT; H. Bany and H. T. Seeley, Yeadon, Pa. App. filed Jan. 5, 1928.

1,717,307. ELECTRIC SWITCH; L. W. Bond, Schenectady, N. Y. App. filed Sept. 10, 1926.

1,717,308. ELECTRIC WATER HEATER; V. Boschetti, West New York, N. J. App. filed Dec. 14, 1927.

1,717,312. RECTIFYING SYSTEM; H. D. Brown and C. A. Sabbah, Schenectady, N. Y. App. filed Sept. 12, 1927.

1,717,317. CONTROLLING MEANS FOR ELECTRIC CIRCUITS; C. Horsley and E. R. Goldfield, Cleveland, Ohio. App. filed July 15, 1927.

1,717,329. ELECTRICAL-CIRCUIT-CONNECTING DEVICE; P. F. Williams, Chicago, Ill. App. filed Oct. 18, 1922.

1,717,342. MANUAL HOLDER FOR ARC WELDING ELECTRODES; A. Marland, Conshohocken, Pa. App. filed Sept. 30, 1927.

1,717,347. TRANSFORMER; G. Camilli, Pittsfield, Mass. App. filed Oct. 10, 1928.

(Issued June 18, 1929)

1,717,360. APPARATUS FOR POLARIZING ULTRA-VIOLET RADIATIONS; W. T. Anderson, Jr., and F. W. Robinson, Newark, N. J. App. filed May 1, 1926.

1,717,366. PROTECTION OF ELECTRIC APPARATUS; M. Buchholz, Cassel, Germany. App. filed June 28, 1927.

1,717,368. DISCONNECTING TYPE OF CABLE END BELL; R. T. Calloway, Chicago, Ill. App. filed March 25, 1922.

1,717,370. FLASH-SIGN ADVERTISING SWITCH APPARATUS; H. S. Coleman, Victoria, London, England. App. filed July 7, 1922.

1,717,383. SINGLE-POLE DOUBLE TRANSFER SWITCH; C. F. James, Taplin, W. Va. App. filed Sept. 14, 1926.

1,717,389. COUPLING MEANS FOR ELECTRICAL CONDUITS AND THE LIKE; A. Kipnis, New York, N. Y. App. filed Aug. 25, 1922.

1,717,400. PHASE-SHIFTING NETWORK; H. Nyquist, Millburn, N. J. App. filed Aug. 25, 1926.

1,717,413. THERMOELECTRIC APPARATUS; R. Rudenberg, Berlin-Grunewald, Germany. App. filed Jan. 27, 1927.

1,717,418. MEANS FOR REGULATING VOLTAGE; M. L. Sindeband, New York, and P. Sporn, Brooklyn, N. Y. App. filed Aug. 9, 1923.

1,717,442. CROSSING-GATE SIGNAL SWITCH; E. A. Everett, New York, N. Y. App. filed July 13, 1923.

1,717,449. HIGH-VOLTAGE SWITCH; L. C. Hart, Cleveland, Ohio. App. filed July 2, 1927.

1,717,460. APPARATUS FOR ELECTROPLATING METALLIC BANDS; J. J. Mascuch, East Orange, N. J. App. filed July 1, 1927.

1,717,462. ELECTROMAGNETIC CHEMICAL BALANCE; H. Nagaoka and J. Ikebe, Tokyo, Japan. App. filed Nov. 10, 1924.

1,717,467. ELECTRIC CIRCUIT CLOSER; N. Schleich and C. J. Aldridge, Great Falls, Mont. App. filed Dec. 27, 1926.

1,717,468. ELECTROPLATING PROCESS; L. Schulte, Pittsburgh, Pa. App. filed May 29, 1926.

1,717,472. HIGH-TENSION SPARK AMPLIFYING MEANS; P. O. Stewart, New York, N. Y. App. filed Dec. 6, 1926.

1,717,475. ALTERNATING-CURRENT RELAY; E. O. Thompson, Tompkinsville, N. Y. App. filed July 19, 1922.

1,717,488. ELECTROLYTIC CONDENSER; E. F. Andrews, Chicago, Ill. App. filed Feb. 26, 1927.

1,717,500. SYNCHRONOUS MOTOR; C. Fayer, Flushing, N. Y. App. filed May 14, 1925.

1,717,517. ALTERNATING-CURRENT RECTIFIER; H. N. Miller, Chicago, and E. W. Engle, Lake Forest, Ill. App. filed Jan. 3, 1928.

1,717,521. COIL AND STAND; F. J. Reichmann, Chicago, Ill. App. filed Aug. 19, 1926.

1,717,525. LAMP; E. E. Slick, Pittsburgh, Pa. App. filed Nov. 28, 1925.

1,717,530. ELECTRIC-ARC WELDING; E. Thomson, Swampscott, Mass. App. filed June 25, 1926.

1,717,550. HEATER MOUNTING; J. H. Carmean, Kansas City, Mo. App. filed March 12, 1928.

1,717,563. CHARGING OF STORAGE BATTERIES; A. W. Hull, Schenectady, N. Y. App. filed Nov. 1, 1926.

1,717,565. ELECTRIC LIGHTER; C. W. Johnson, Cambridge, Mass. App. filed Aug. 11, 1928.

1,717,581. SYSTEM OF DISTRIBUTION; D. C. Prince, Schenectady, N. Y. App. filed Sept. 20, 1923.

1,717,589. LIGHTNING ARRESTER; F. S. Smith, Philadelphia, Pa. App. filed Oct. 10, 1922.

1,717,592. COOKING APPARATUS; D. O. Wheelock, Miller, S. D. App. filed March 15, 1926.

1,717,617. SIGNAL; M. M. Moore, Altadena, Calif. App. filed May 11, 1927.

1,717,628. THERMOSTATIC ELECTRIC SWITCH; H. J. Sauvage, Chicago, Ill. App. filed Jan. 11, 1927.

1,717,638. MOVEMENT-INITIATING DEVICE; H. F. Waters, St. Louis, Mo. App. filed June 4, 1928.

1,717,712. RESISTOR AND METHOD OF MAKING SAME; S. Loewe, Berlin, Friedenau, Germany. App. filed Jan. 17, 1927.

1,717,722. HIGH-SPEED REGULATOR AND GOVERNOR; R. Mayer, Berlin, Germany. App. filed Jan. 23, 1926.

1,717,729. GANG-OPERATED DISCONNECTING SWITCH; H. W. Morreall, Pine Grove, Pa. App. filed Oct. 20, 1925.

1,717,779. METHOD OF WELDING; W. R. Hume, Melbourne, Victoria, Australia. App. filed Dec. 29, 1928.

1,717,785. METHOD OF AND MEANS FOR PRODUCING ILLUMINATION EFFECTS; F. J. Kaehni and W. L. Kaehni, Cleveland, Ohio. App. filed June 25, 1928.

1,717,823. CONTROL OF DYNAMO-ELECTRIC MACHINES; M. A. Whiting, Schenectady, N. Y. App. filed April 3, 1924.

1,717,831. VOLTAGE REGULATOR; C. A. Borland, La Grange, and A. F. Melching, Forest Hills, Ill. App. filed March 31, 1927.

1,717,836. MULTIPLE ELECTRIC CONNECTING DEVICE; B. F. Conner, Hartford, Conn. App. filed May 27, 1927.

1,717,844. MOTOR-CONTROL MECHANISM; L. P. Hutt, Schenectady, N. Y. App. filed Dec. 19, 1924.

1,717,850. ELECTRIC DISCHARGE DEVICE; F. W. Peek, Jr., Pittsfield, Mass. App. filed Dec. 19, 1925.

1,717,852. LOAD REGULATION OF MECHANICALLY-COUPLED MOTORS; A. A. Pollock, Leamington Spa, England. App. filed June 1, 1927.

1,717,862. ELEVATOR CONTROL; M. A. Whiting and E. D. Harrington, Schenectady, N. Y. App. filed Jan. 22, 1926.

7,717,863. STORAGE BATTERY; T. A. Willard, Cleveland Heights, Ohio. App. filed April 10, 1922.

1,717,871. SECTIONAL GANG PLATE; T. A. Both, Stratford, Conn. App. filed Dec. 4, 1922.

1,717,885. MOUNTING FOR ELECTRIC CONDUCTORS; A. H. Leipert, New York, N. Y. App. filed March 17, 1928.

1,717,919. PROTECTIVE ELECTRICAL CONNECTING DEVICE; A. Ehrler and I. Amundsen, New York, N. Y. App. filed Dec. 3, 1925.

7,717,940. ELECTRIC SWITCH; J. V. Schafer, Bronson, Mich. App. filed Feb. 9, 1927.

1,718,017. COMPENSATING THERMAL RELAY; G. H. Whittingham, Baltimore, Md. App. filed March 17, 1927.

1,718,040. TOGGLE SWITCH; P. R. Forman, Rahway, N. J. App. filed Sept. 29, 1927.

1,718,044. VIBRATING MOTOR; J. M. High, Jr., New York, N. Y. App. filed Oct. 16, 1926.

1,718,086. BATTERY-ELEMENT PACKAGE; J. M. Skinner, Philadelphia, Pa. App. filed Feb. 1, 1922.

1,718,103. PROCESS OF EXTRACTING MERCURY FROM CINNABAR; W. C. Baxter, Berkeley, Calif. App. filed April 13, 1926.

1,718,106. ELECTRIC HEATING ELEMENT; S. S. Bolsinger, Roseburg, Ore. App. filed Oct. 8, 1927.

New Trade Literature

CONTROL DEVICE — Curtis Lighting, Inc., 1119 West Jackson Boulevard, Chicago, has issued pamphlets covering its "Lumitone," a device for either manual or automatic remote control of mobile color lighting.

STOKERS.—The Stoker Manufacturers' Association, Detroit, has issued a revised edition of its condensed catalog of mechanical stokers. It illustrates and describes the construction and operation of 46 different types of stokers manufactured by the members of the association. A data section, dealing with boiler setting heights, stack diameters, stack heights, heat balance calculation, air requirements for forced draft, etc., also is included.

CONTROLLERS AND SUPERVISORY CONTROL UNITS.—Leaflet No. L 20,388 issued by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., describes and illustrates its new line of class 12-700 type A reversing drum controllers for wound-rotor induction motors. The company also is distributing circular No. 1834, entitled "Synchronous Visual Supervisory Control," which describes the present types of Westinghouse supervisory control units, giving their application, advantages and system of operation. The circular is well illustrated with typical control equipment.

LIGHTNING ARRESTERS.—"Performance" is the title of booklet No. 270, the eighth of a series describing the technical features of the crystal valve lightning arrester, which is being issued by the Electric Service Supplies Company, Seventeenth and Cambria Streets, Philadelphia.

CABINETS.—The Savage Arms Corporation, 100 East 42d Street, New York City, is distributing a folder covering its "Mercury" refrigerating cabinets for preserving ice cream. The Savage "Mercury" compressor also is described and illustrated.

PUMPS.—The Eisler Engineering Company, Inc., Newark, N. J., is distributing catalog P, which describes and illustrates the Eisler "high vacuum" pumps.

COMPRESSORS, EXHAUSTERS, ETC.—Bulletin No. A-50 issued by the Allen Air Appliance Company, Inc., 452 Lexington Avenue, New York City, describes and illustrates the triple-A centrifugal compressors, blowers, exhausters and stationary and portable vacuum cleaner equipment.

SWITCHES.—Bulletin No. 1-I issued by the Champion Switch Company, Kenova, W. Va., describes and illustrates its new type VB air-break switches for voltages up to and including 220 kv.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number:

Purchase is desired in Winnipeg, Canada (No. 39,197), of electric clocks.

Purchase is desired in Mexico City, Mexico (No. 39,174), of electric furnaces and tungsten wire.

Purchase and agency are desired in Turin, Italy (No. 39,166), for household electrical appliances.

Purchase is desired in Edmonton, Canada (No. 39,165), of electric traffic signals.

Purchase or agency is desired in Berlin, Germany (No. 39,164), for tungsten wire.

An agency is desired in Edmonton, Canada (No. 39,167), for vacuum cleaners.

Purchase is desired in Oporto, Portugal (No. 39,196), of rubber insulated wire.

An agency is desired in Tegucigalpa, Honduras (No. 39,181), for Diesel and semi-Diesel motors and steam engines and boilers.

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Founded 1874—Fifty-Five Years of Service

JUL 1 1929

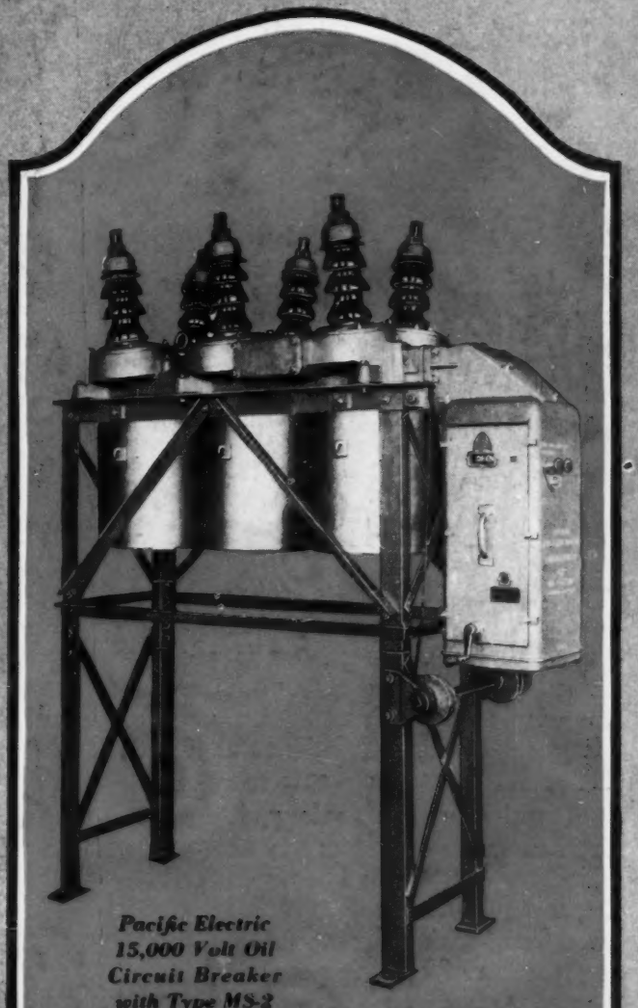
Electrical World

McGraw-Hill Publishing Company, Inc. JUNE 29, 1929 Twenty-five Cents Per Copy

A *NEW* MECHANICAL AUTOMATIC RECLOSE

Pacific Electric Type MS-2 Motor wound, spring actuated controls are now offered with a mechanical reclose automatically operating fifteen seconds after initial interruption.

This is accomplished without the use of relays or additional electrical circuits and requires no resetting or handling.

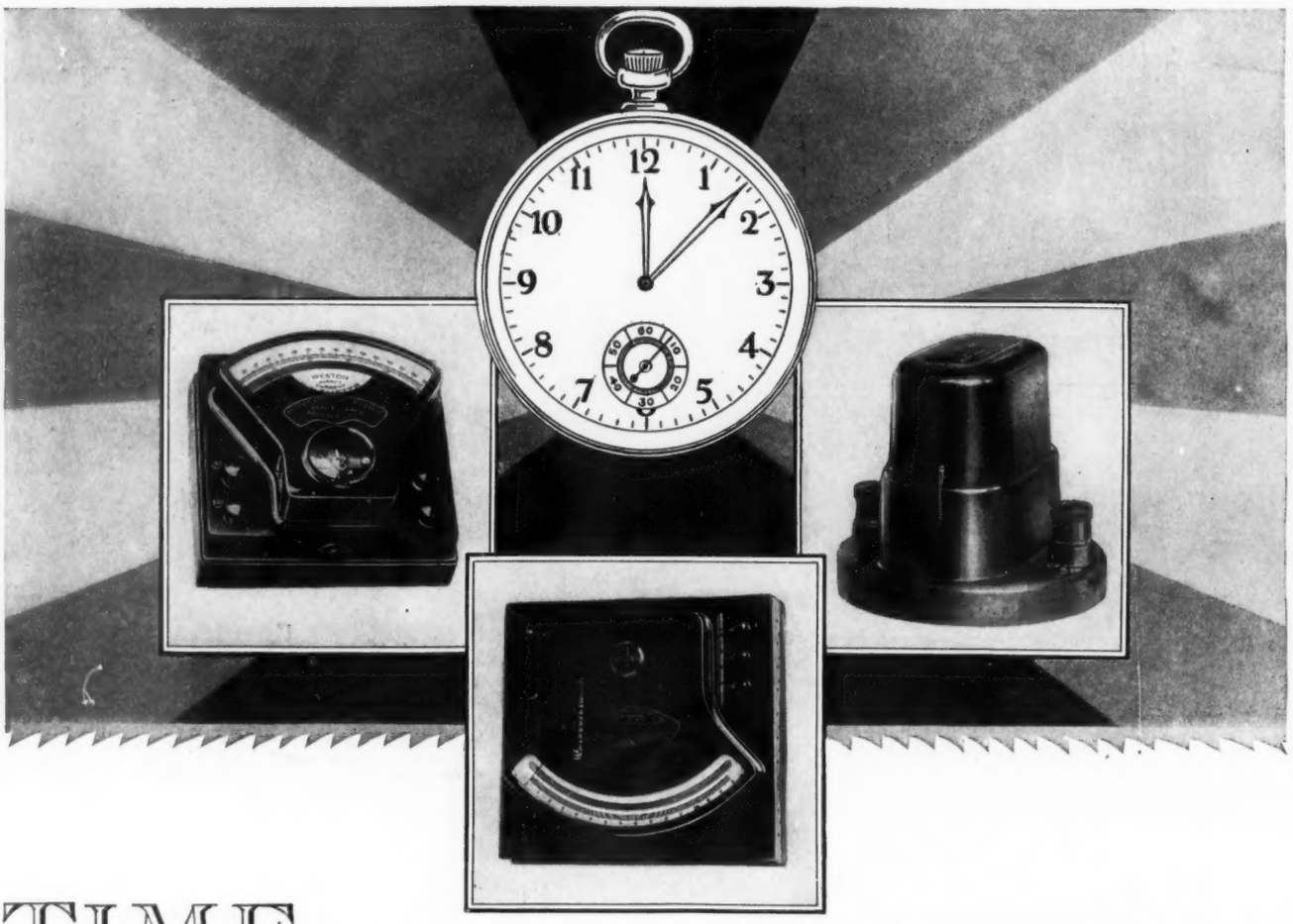


Pacific Electric 15,000 Volt Oil Circuit Breaker with Type MS-2 Motor Control

Pacific Electric Mfg. Corporation.

5815 THIRD STREET, SAN FRANCISCO, CALIFORNIA

Representatives in Principal Cities



TIME—*the Sponsor of Quality and Service*

ELECTRICITY is frequently referred to as the mainspring of industry. It is an apt analogy since, when electric power is properly proportioned to the needs of production machinery, and the whole system is nicely balanced electrically, factory equipment functions much like the works of a well-regulated and extremely accurate watch.

Continuing the analogy, if time-accuracy is deemed necessary in industry as a gauge on human efficiency, how much more essential is the absolute dependability of instruments used for checking the efficient application of electric power to every phase of plant operation, for electricity affects practically every activity incident to production—the output of the individual as well as the machine. The established standards for the measurement of time and electricity employed in modern practice are comparable only in their mechanical refinements.

There are put into each Weston instrument long hours of time so as to insure long years of dependable service

The finest watch that was ever made resulted from simple operations compared with the extreme complexity of processes—chemical and electrical as well as mechanical—required to produce many of the small parts and elements essential to the maintenance of Weston standards of performance.

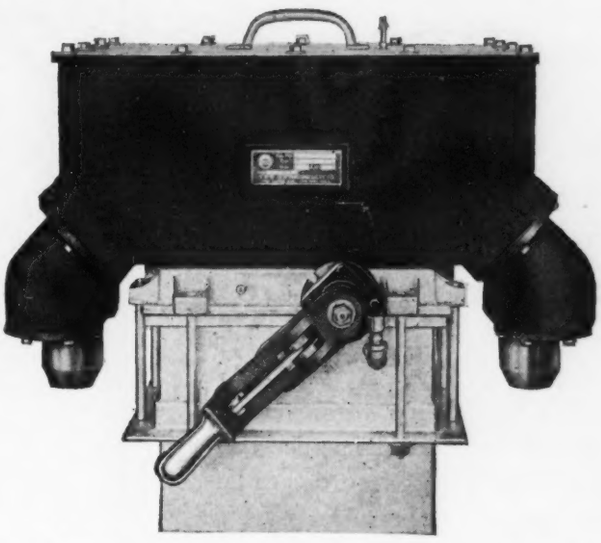
There is no sacrifice of highest quality—either of materials or workmanship—permitted in a world-famed Weston. Notwithstanding the many precise manual and mechanical operations, the hundreds of inspections and tests and the incredibly small tolerances and working limits prescribed, the cost of a "Weston" is remarkably low—in the smaller sizes even under the price of the cheapest watch!

Pursuing the watch analogy to a concluding reminder—it takes time to make a "Weston" as it does any quality product, a fact which in the end brings greatest satisfaction to the purchaser and user.

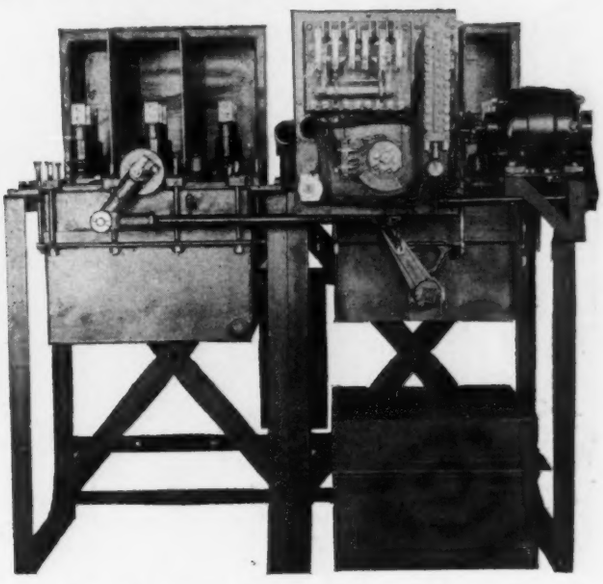
Weston
PIONEERS SINCE 1888
INSTRUMENTS

WESTON ELECTRICAL INSTRUMENT CORPORATION
578 Frelinghuysen Avenue - Newark, N. J.

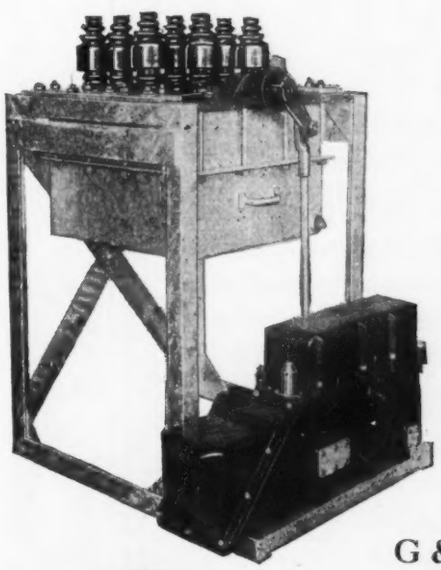
G & W Oil Switches can be built for any operating or space requirement



Type WUL submersion type single throw oil switch. Made in 2/c, 3/c, and 4/c for 400 amperes at 5000 volts. Has separate air disconnects. Furnished for manhole or vault use. Also arranged for braided cables. Manually or electrically operated or full automatic. Ideal for feeder sectionalization.



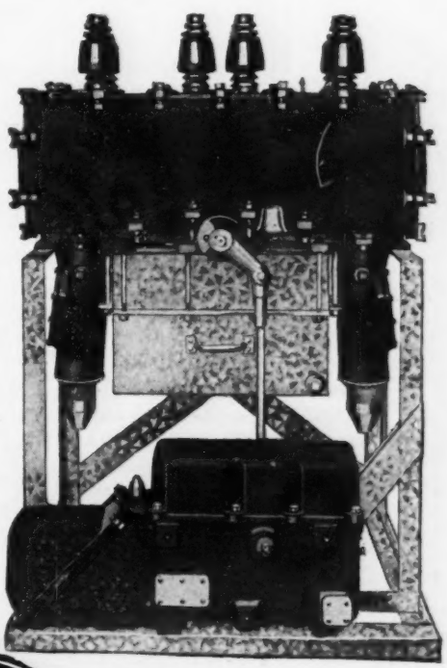
Two type VP oil switches arranged in tandem. 3/c—200 amperes—4500 volt double throw switches. Each has three positions—on—off—on. Is completely automatic as part of automatic boiler control. Also has provision for remote push button control or manual operation at switch. Used to control two 2300 volt two speed draft motors. Also furnished in four positions for three speed motors.



Two types of 4500 volt—200 ampere—double throw oil switches operated by G & W automatic throwover. Use in primary distribution work. For use indoors or outdoors. Provides preferred and emergency feeds for important service or for primary main.

Left: Type VP with porcelain enclosed air disconnects. Often used on overhead platforms or in vaults.

Right: Type VU with by-pass and disconnect air break plugs in top chamber. Can interconnect feeds or by-pass oil switch without killing load.



G & W Electric Specialty Co.
7780 Dante Ave., Chicago, Ill.

Exactly What You Want

See our Catalog No. 27

More than Protection **G&W** for the Cable Ends

POTHEADS AND BOXES

HITENSO "BB"

TRANSMISSION WIRE

for long span construction in rural electrification

HITENSO "BB" Wire was developed to permit the use of long span construction with light poles in order to cut the cost of transmission lines.

It is a high strength, high conductivity wire. It has 85% of the conductivity of hard drawn copper, and compared with hard drawn copper of equivalent conductance has 35% greater strength.

Since the initial investment for poles and hardware is generally greater than the cost of conductors, the use of longer spans made possible by Hitenso "BB" helps to lower the cost of rural installations.

Hitenso "BB" is also an important factor in reducing maintenance expense. It is highly resistant to abrasion and the effect of arcing. Its small diameter for a given strength reduces the surface and lessens the danger of line failure from sleet and wind.

An Engineering Department is maintained to assist electrical engineers in the design of cables for special conditions. You are invited to make use of this service.

ANACONDA WIRE & CABLE CO.

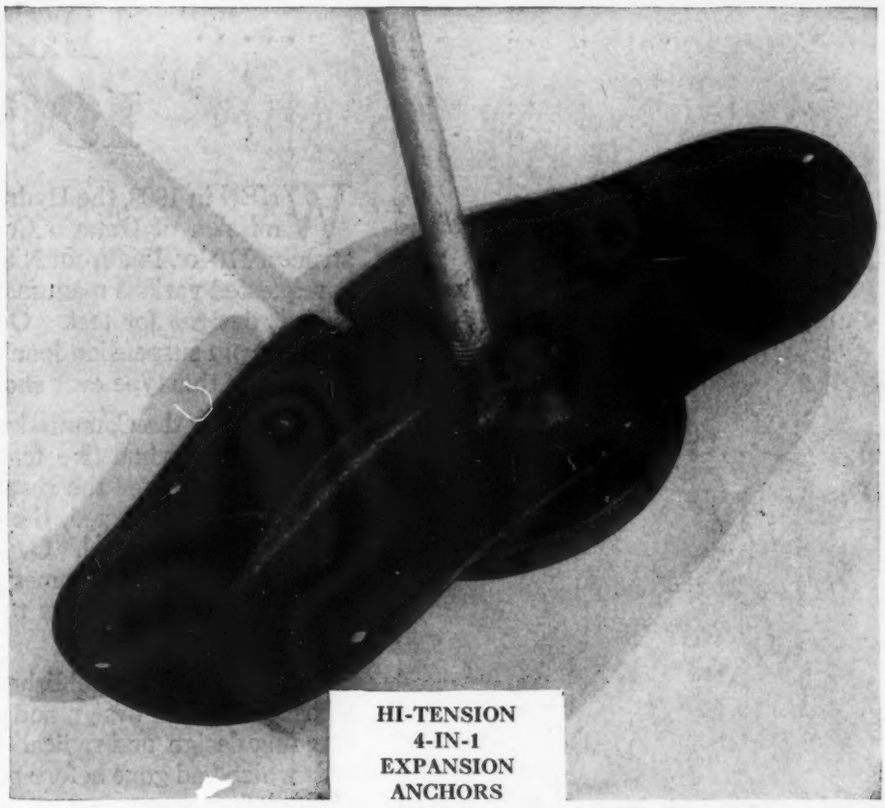
General Offices: 25 Broadway, New York
Chicago Office: 111 West Washington St.
Exclusive Selling Agent for Wire and Cable Products of
THE AMERICAN BRASS COMPANY

ANACONDA

THE high conductivity and uniform quality of Anaconda Metals are the result of the co-ordinated supervision by a single organization of every process from ore to finished product. Seven wire mills offer a coast-to-coast service unequalled for promptness and dependability.

ANACONDA WIRE PRODUCTS

HOLDING POWER GREATER Than ONE THOUSAND TIMES THE ACTUAL WEIGHT IN POUNDS (Certified Malleable Iron)

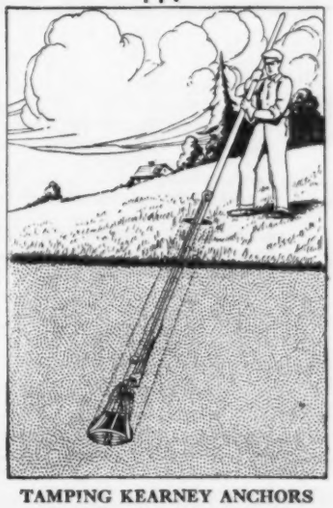


HI-TENSION
4-IN-1
EXPANSION
ANCHORS

Holding Power Essential

KEARNEY HI-Tension 4-in-1 Expansion Anchors are suitable for use in a majority of soils, at any angle, to any depth, and in any location. They have no equal as to holding power on equal inches of surface. The anchor consists of two blades, and a plate, having no movable parts which could become broken during installation. These anchors give a great compression of earth when being expanded because of the pitch of the blades. Each of five sizes of Kearney HI-Tension 4-in-1 Expansion Anchors expands to two and one-half times its rated size. Bulletin No. 301 gives complete details. Write for your copy today.

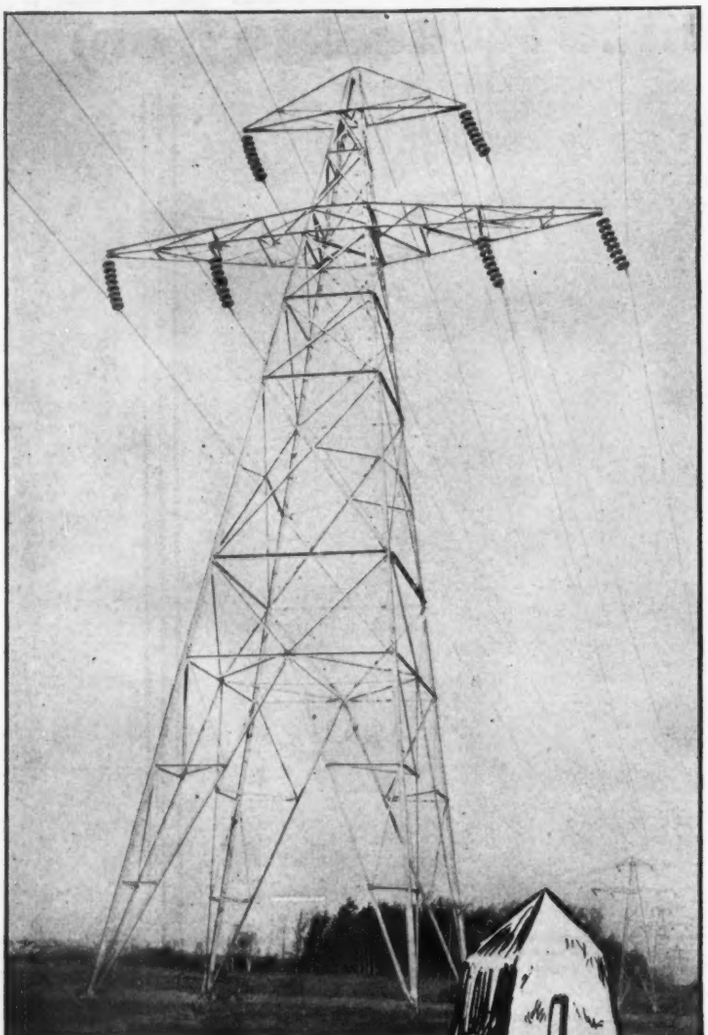
JAMES R. KEARNEY CORPORATION
4224-32 CLAYTON AVE. . . . ST. LOUIS, MO.
Factories: St. Louis, Mo., Kansas City, Mo., Taylorville, Ill.



TAMPING KEARNEY ANCHORS
TO FULL SIZE WITH EASE.

A KEARNEY PRODUCT
BEING ADOPTED NATIONALLY AS STANDARD EQUIPMENT

MILESTONES



A view of the Niagara Falls-Toronto line of the Hydro-Electric Power Commission of Ontario, erected in 1909 and energized at 110-kv. The illustration shows the original O-B cap and pin suspension units—8 units to the string—employing an eleven inch porcelain disk and a slate glaze. Unit spacing 6 inches.

Milestones of Line Con 1909

WHEN in 1909, the Hydro-Electric Power Commission of Ontario ,Canada decided to construct a 110-kv. line from Niagara Falls to Toronto it requested various manufacturers of insulators to submit designs for test. O-B offered a one piece cap and pin suspension insulator, petticoat type—the first of this type ever shown.

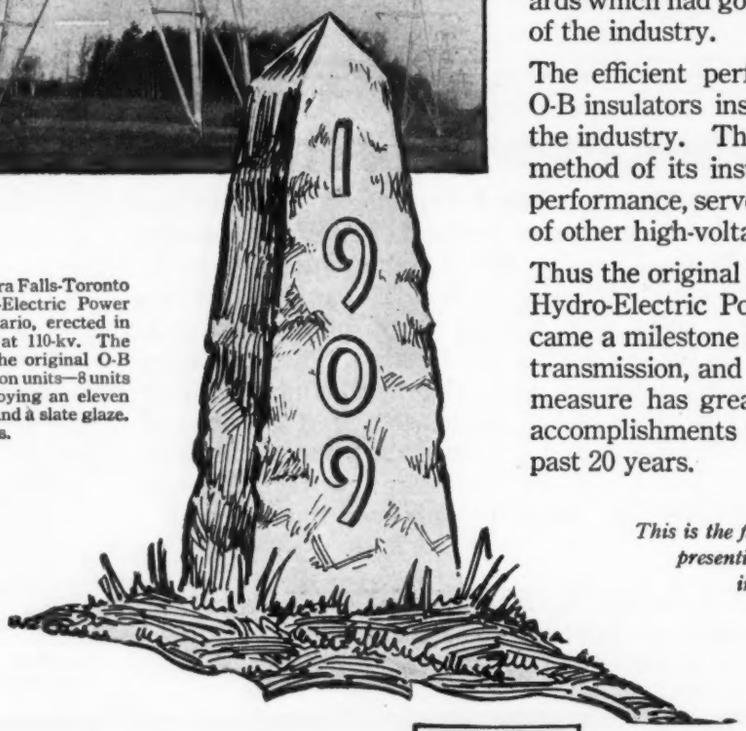
Engineers for the Commission subjected these samples to most exhaustive tests, both electrical and mechanical. After the results had been carefully tabulated and analyzed, the O-B cap and pin type insulator was selected. Over 65,000 of these units were ordered in the summer of 1909, the design of the line calling for 8 units to the string to be used on 65-ft. steel towers.

This 283-mile line established a new standard for transmission line design and construction. Its outstanding design and radical departure from standards which had gone before put it into the lime-light of the industry.

The efficient performance of this line, and of the O-B insulators installed on it, won the approval of the industry. The design and plan of the line; the method of its insulation; and the character of its performance, served as a guide for the construction of other high-voltage lines.

Thus the original Niagara Falls-Toronto line of the Hydro-Electric Power Commission of Ontario became a milestone in the progress of electric power transmission, and an achievement that in no small measure has greatly aided to the industry in the accomplishments which have followed during the past 20 years.

This is the first of a series of advertisements presenting the 20 year story of O-B insulator development.



MILESTONES

Transmission Construction 1929

THE 20 years which have followed the erection of the original Niagara Falls-Toronto line cover a period of remarkable development and expansion by the Hydro-Electric Power Commission of Ontario.

As this original line was an outstanding achievement of 1909 so is the Gatineau Line equally outstanding in 1929.

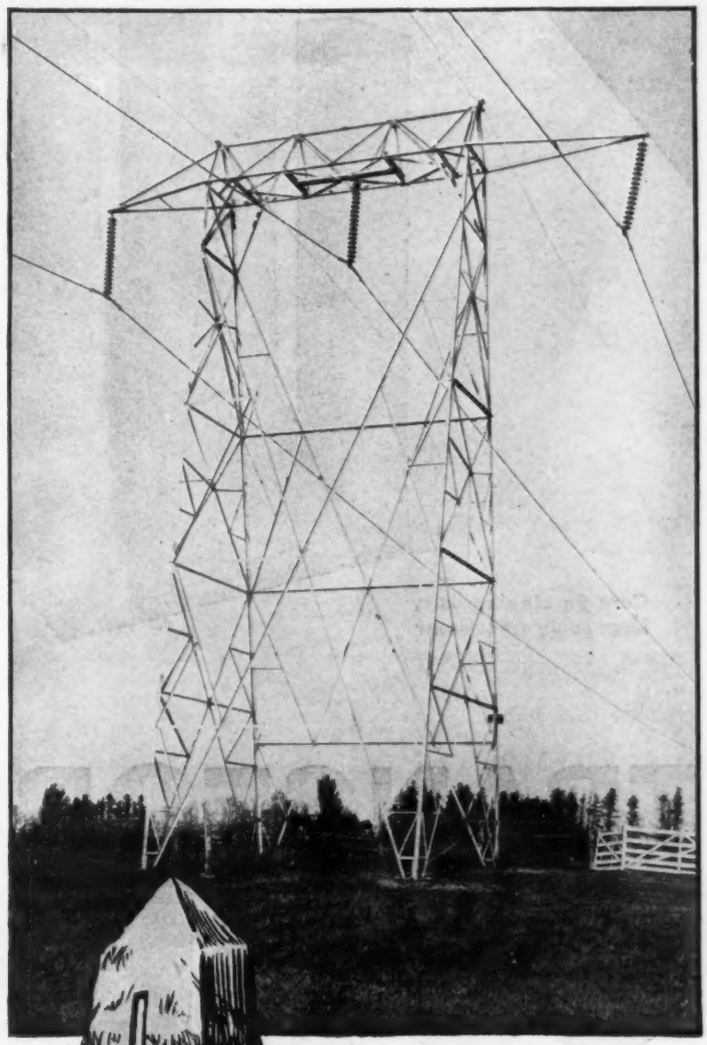
From Paugan Falls in upper Quebec to the Leaside sub-station at Toronto, this 230 miles, 220-kv. line will bring 260,000 h. p. to the Hydro-Electric Power Commission system.

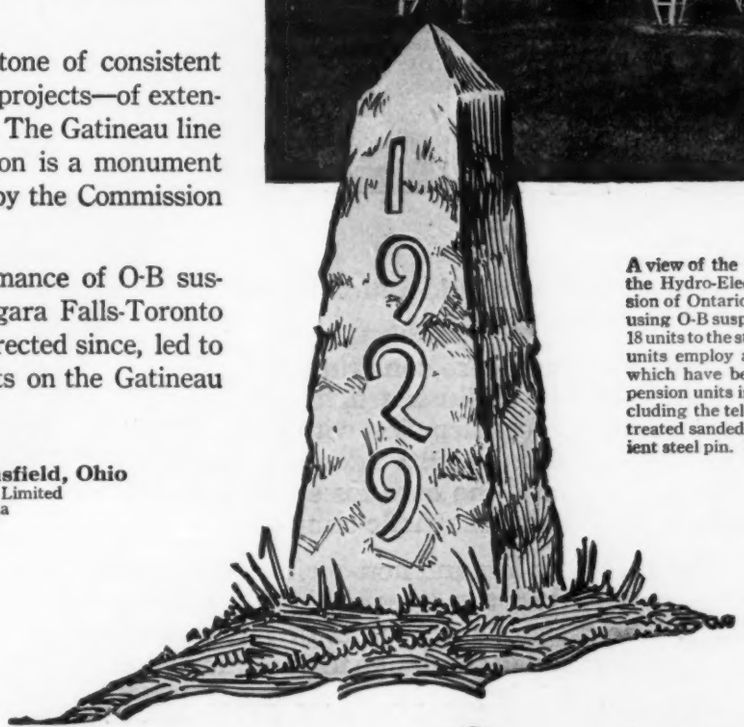
This new line represents the most improved designs in tower construction; the latest and most advanced thinking in high-voltage insulation; and is the result of engineering effort of the highest order, utilizing all of the experience and skill available at this date.

Thus is recorded another milestone of consistent development—of hydro-electric projects—of extensive transmission line building. The Gatineau line of the Hydro-Electric Commission is a monument to 20 years of service rendered by the Commission to the people of Ontario.

The satisfactory earlier performance of O-B suspension insulators on the Niagara Falls-Toronto line, and on many of the lines erected since, led to the use of thousands of O-B units on the Gatineau line.

Ohio Brass Company, Mansfield, Ohio
Canadian Ohio Brass Co., Limited
Niagara Falls, Canada
1031H





A view of the new Gatineau line of the Hydro-Electric Power Commission of Ontario energized2 at 20-kv., using O-B suspension unit No. 25620, 18 units to the string as shown. These units employ all of the refinements which have been added to O-B suspension units in the past 20 years, including the tell-tale color glaze, the treated sanded surface; and the resilient steel pin. Unit spacing 5 inches.

Ohio Brass Co.

PORCELAIN INSULATORS
LINE MATERIALS
RAIL BONDS
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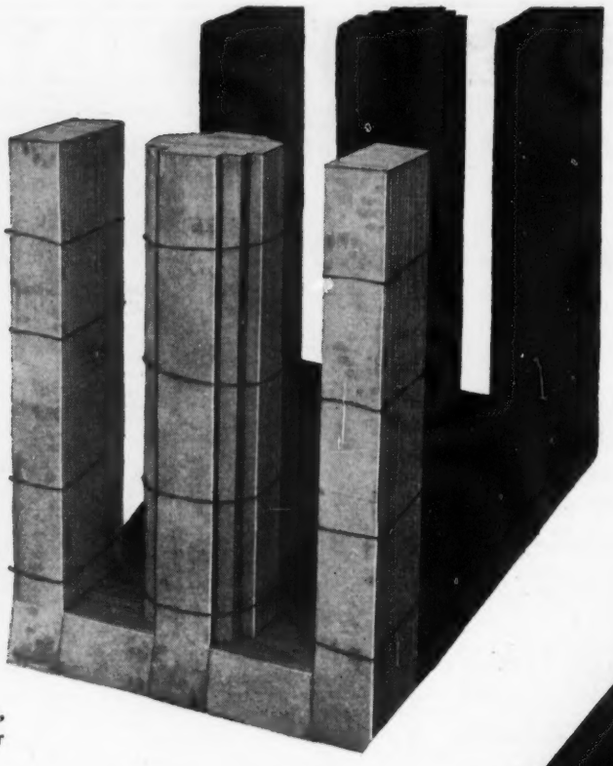
NEW YORK CHICAGO PHILADELPHIA BOSTON PITTSBURGH ATLANTA ST. LOUIS SAN FRANCISCO CLEVELAND LOS ANGELES



Core for single phase, large power transformer

TRANSFORMER CORES

They also merit careful consideration in the selection of transformers.

The standard Kuhlman core construction is of the modified shell type as illustrated, to combine the advantages of rigid construction with good performance. This design permits adequate ventilation, better bracing, and the core losses are reduced as a result of the divided magnetic circuit.

A special grade of low-loss and non-ageing silicon steel has long been used for the cores of Kuhlman Transformers. The magnetic properties of this material are a consideration in the design to minimize losses.

KUHLMAN ELECTRIC CO., BAY CITY, MICH.

KUHLMAN TRANSFORMERS

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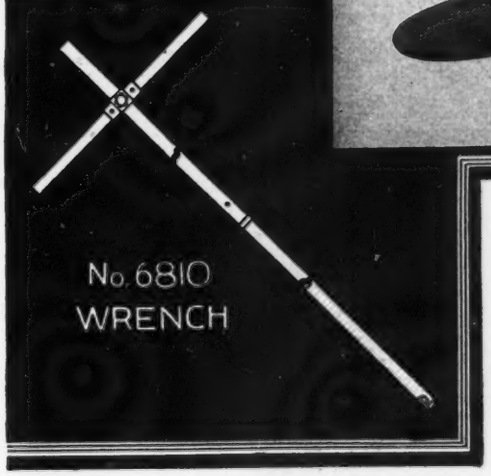
SCRULIX ANCHORS
Screw Down Deeper~ *Faster*

Greater Holding Power



Speed installations in baked clay, adobe, hard-pan or disintegrated rock by boring a small pilot hole with the Matthews Earth Auger. Savings made on a few installations will quickly pay for it.

Engineers and users agree that Matthews Scrulix Anchors are the ideal all-purpose anchor. Made in all popular sizes in either gray or malleable iron

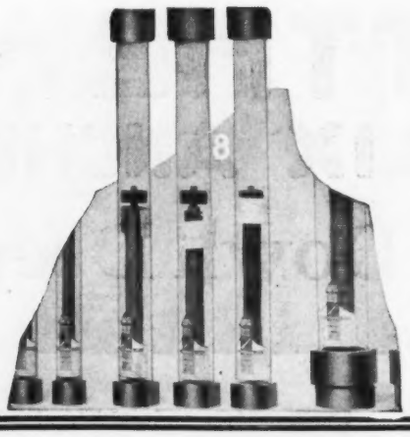
The 6810 Wrench is of new design and enables your men to screw the pre-heated certified malleable Matthews Scrulix Anchors down to at least six feet with little effort. The force of the wrench is on the back edge of the helix and not on the shank.

Write for additional information. Your wholesaler can supply you with Matthews Electrical Specialties. W. N. MATTHEWS CORPORATION, Engineers and Manufacturers, 3702 Forest Park Blvd., St. Louis, Mo. Offices in all principal cities.

W.N. MATTHEWS CORPORATION ST. LOUIS U.S.A. ESTABLISHED 1892

MATTHEWS ELECTRICAL SPECIALTIES

This set of 3
S&C Fuses

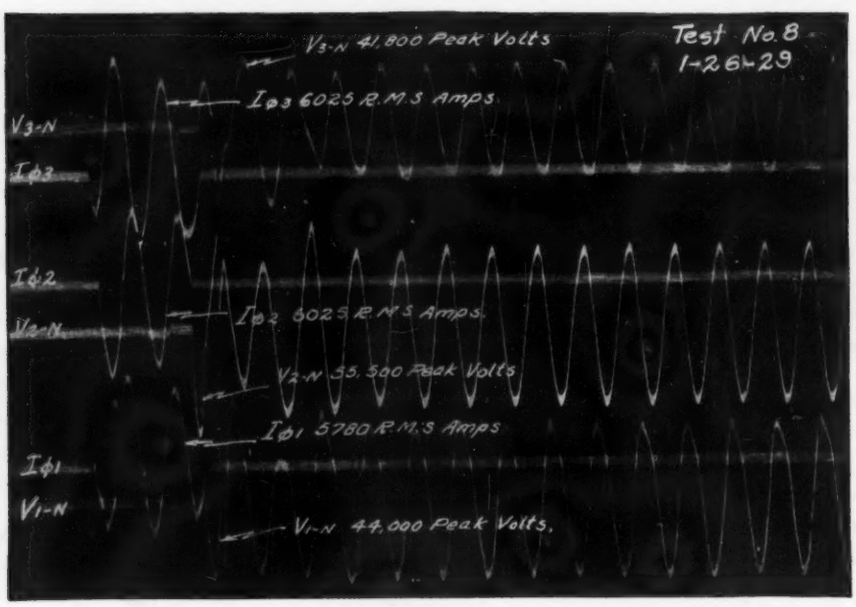


connected

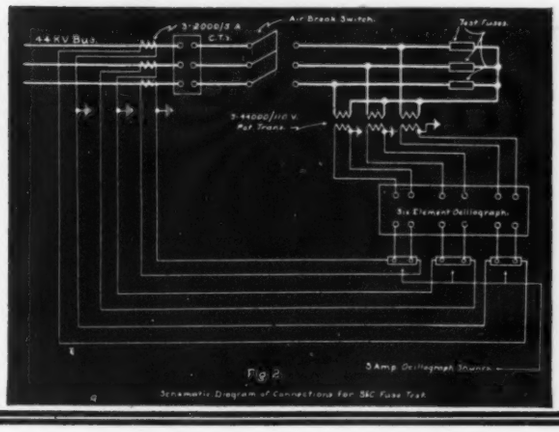
Interrupted

All of the 75 fuses tested interrupted 3 phase

The engineers of a large electric power company, in a Southern State, recently wanted to assure themselves definitely what protection they could depend upon from the S&C Fuse, and decided to conduct a thorough test on their own system.



As reported by the oscillograph



this way

on a

44,000 volt

system

450,000 kva.

short-circuits of from 25,000 to 460,000 KVA.

Twenty-five sets of S&C Fuses were tested three phase, at 44,000 volts. Starting at 25,000 kva., the short-circuit energy was raised step by step to a maximum of 460,000 kva. — all the available short-circuit energy at the particular station.

Oscillograph records showed that the fuses successfully cleared the short-circuits in all cases.

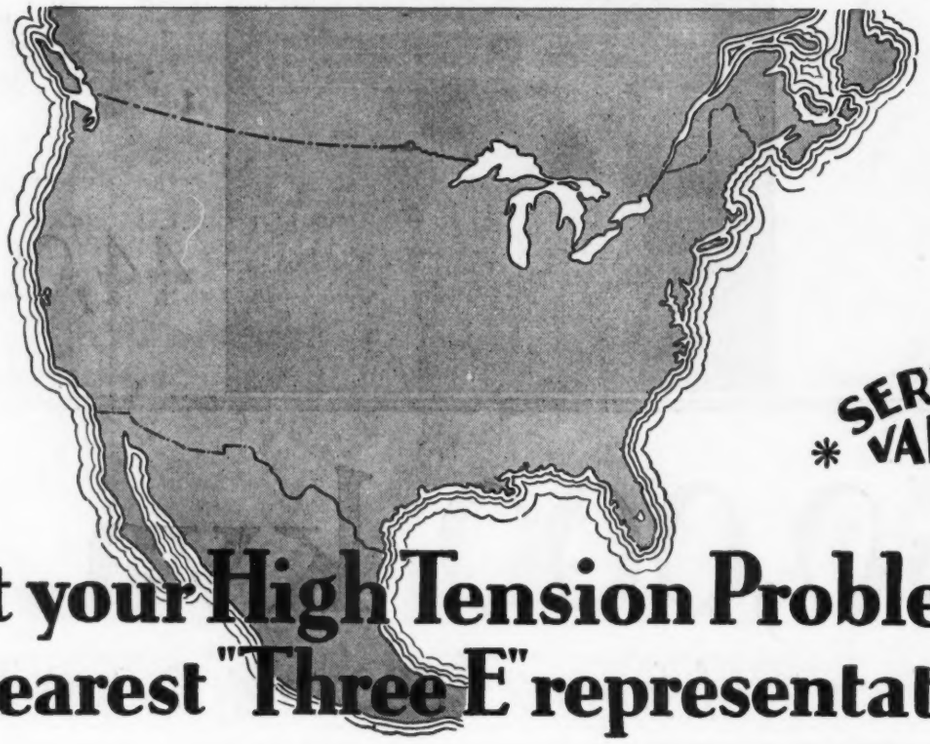
A typical oscillogram from one of the tests is reproduced here and it presents a clear picture of the excellent performance of the S&C Fuse under very severe conditions.

This is additional proof that for high interrupting capacity and dependability "there is no substitute for the S&C Fuse."

For
Best Operation of S&C Fuses
use S&C Mountings or at least specify S&C Fuse Contact Clips when ordering mountings elsewhere.

SCHWEITZER S&C CONRAD, INC.

4435 RAVENSWOOD AVENUE CHICAGO, ILLINOIS U.S.A.



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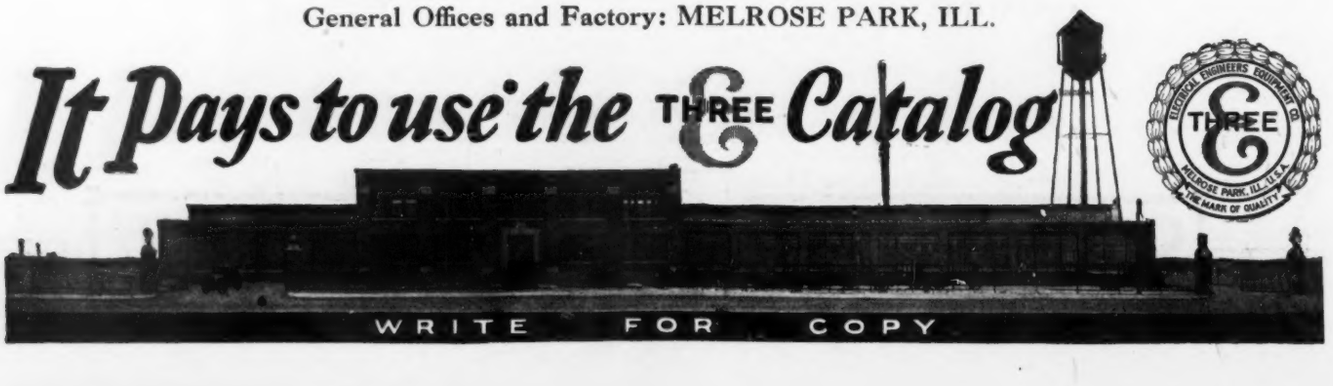
* "Service Value" = Low cost per year of service.

ELECTRICAL ENGINEERS EQUIPMENT CO.
General Offices and Factory: MELROSE PARK, ILL.

It Pays to use the THREE E *Catalog*



Aloft and Alow

ALOW—The Condit M-9 Manhole Oil Circuit Breaker, stout and tight as a ship's hull—built to withstand the ravages of long continuous service below the surface. Furnished for either multi or single-conductor cable as required.

ALOFT—The Condit PK-9 Pole Line Oil Circuit Breaker likewise capable of riding out the fiercest onslaughts of the elements—ideal for outdoor service of moderate capacity.

"*Get in touch with Condit*"

CONDIT ELECTRICAL MFG. CORPORATION
Manufacturers of Electrical Protective Devices
BOSTON, MASS.

Northern Electric Company
LIMITED
Distributor for the Dominion of Canada

SPECIFICATIONS: *Types PK-9 and M-9 400, 600 and 800 amperes at 7500 volts. Estimated interrupting capacity 3000 amperes at 7500 volts. Non automatic or automatic.*

CONDIT

The NEVER-CREEP Anchor

it pulls against SOLID EARTH

Every Chance Anchor Rod is equipped with either the patented, drop-forged Thimbleye, or Twineye as desired, which makes "pulling in" a snap and saves the cost of a thimble. It preserves the guy cable in its full cylindrical strength, giving 25% to 33% greater tensile strength and 20% more transverse strength than the ordinary eye rod.

NEVER-CREEP Anchors are Super Dead-Men . . . the real backbone of the line. No matter what load, a Never-Creep can be depended upon to do the work. One Piece Plate—One Piece Rod—No parts to bend or break and no nuts or threads to strip.

A Never Creep for Every Requirement—from a small 5″ x 10″ plate, to install in a 5″ hole up to a 24″ x 36″ to use in machine bored holes.

Specify *Chance Anchors* for *better* service: Chance New Improved Cones—Chance Expanding—Chance Improved Screws—ALL are GUARANTEED.

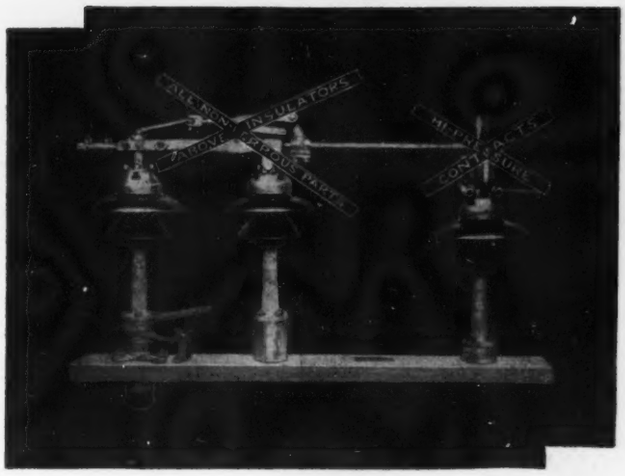
Chance
LINE EQUIPMENT & TOOLS
Co.
CENTRALIA MISSOURI

Ask about our Dead-Men Fixtures and other Chance Specialties.

Catalog on request.

"The Margin of Quality Distinguishes"

X marks the spot -



where the trouble **was** and also how it has been eliminated by the —

OXIDATION has a marked influence on the operation of outdoor switches. Hundreds of trouble cases and thousands of dollars damage can be traced to its activitiy. Oxidation may be in the form of ordinary red rust, which attacks ferrous metals so viciously, or it may be copper oxide, augmented by salt air, fog, dirt or acid fumes, which interferes with the flow of current between contact elements and causes heating that often becomes serious. Fortunately, its effects can be — and have been — reduced to a minimum.

In the Hi-Pressure Contact Switch, with all non-ferrous parts above the insulator units, and with the absence of tapped holes and screws,—the red rust menace has been practically removed. Likewise, with the event of self-cleaning Hi-Pressure Contacts, a method for removing this Oxide film is provided, making bright, new contact surfaces with each switch operation. Thus, contact resistance is reduced to a minimum . . . There is nothing theoretical about it . . . R. & I. E. Switching equipment will minimize your operating expense to a degree that will be gratifying to you.

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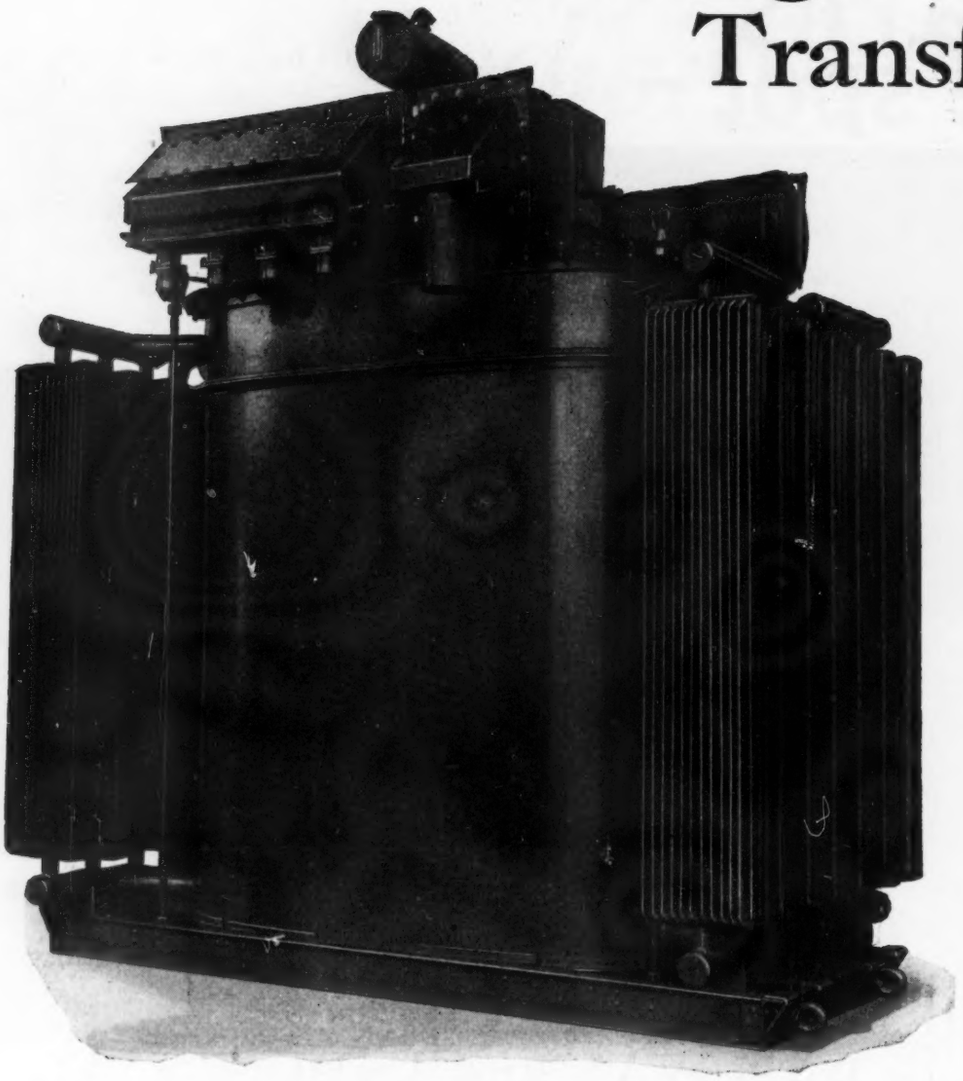
HI-PRESSURE CONTACT

Pittsburgh Transformers



This Pittsburgh Polyphase Transformer is rated at 5250 kva., 13,800 delta volts high side and 2400 delta /4150 star volts low side. It is arranged for cable connections for both high and low voltage sides by means of potheads. The potheads are oil filled and may be disconnected from the transformer as a unit. This permits the transformer to be disconnected from the cable system without disturbing the wiped cable joints.

PRODUCTS:

Electrical Machinery
Steam Turbines
Condensers
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Hydraulic Turbines
Centrifugal Pumps
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Crushing Machinery
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Flour & Saw Mill Machinery
Steam & Electric Hoists
Farm and Industrial Tractors
Power Transmission Machinery

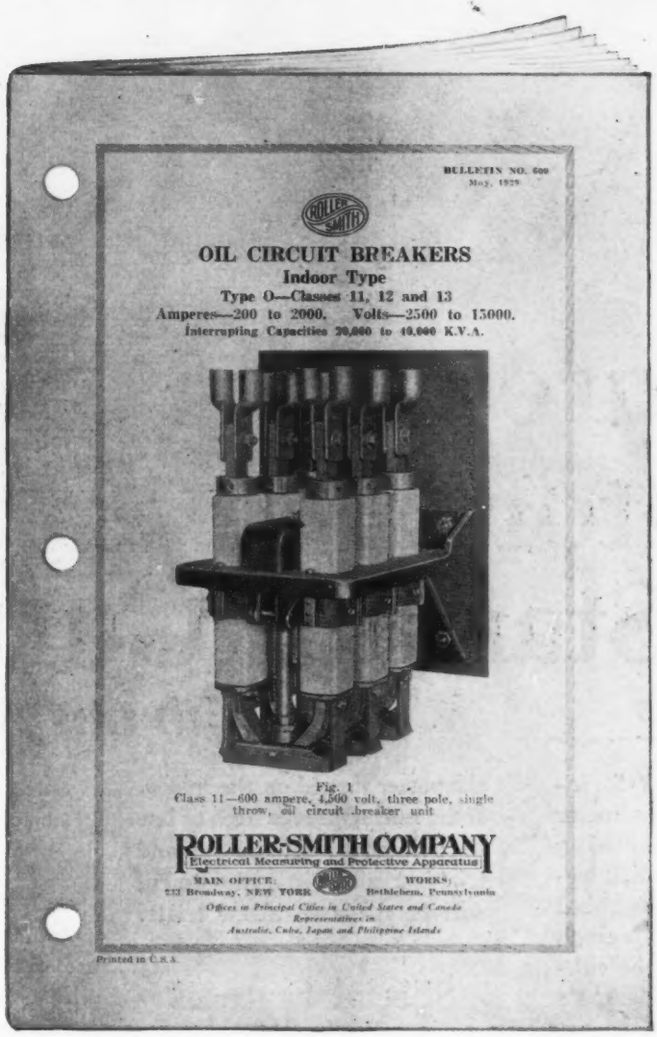
Pittsburgh Power Transformers, both single phase and polyphase have a double magnetic circuit core. This results in more efficient operation. The tanks and the radiators are built of copper alloy (rust resisting) steel. The rectangular base construction facilitates moving and handling. Pittsburgh Transformers with film type radiators save in floor space. Fewer radiators are required because of their very efficient heat dissipation.

ALLIS-CHALMERS MANUFACTURING CO.

PITTSBURGH TRANSFORMER WORKS

North Side, Pittsburgh, Pennsylvania

ROLLER-SMITH
ANNOUNCES


BULLETIN NO. 600
May, 1929
OIL CIRCUIT BREAKERS
Indoor Type
Type O—Classes 11, 12 and 13
Amperes—200 to 2000. Volts—2500 to 15000.
Interrupting Capacities 20,000 to 40,000 K.V.A.
Fig. 1
Class 11—600 ampere, 4,500 volt, three pole, single throw, oil circuit breaker unit
ROLLER-SMITH COMPANY
Electrical Measuring and Protective Apparatus
MAIN OFFICE:
233 Broadway, NEW YORK
WORKS:
Bethlehem, Pennsylvania
Offices in Principal Cities in United States and Canada
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Australia, Cuba, Japan and Philippine Islands
Printed in U.S.A.

This bulletin gives in simple but complete form, all the details of this new Roller-Smith development. The information is in get-at-able shape for the busy man. Everyone who is interested in oil switches and circuit breakers should have a copy.

A NEW BULLETIN

On the new line of Oil Circuit Breakers

as shown in Electrical World, May 4th, May 25th and June 8th issues—Use the coupon for a copy.

"Over thirty years' circuit breaker experience is back of ROLLER-SMITH"

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237 Broadway, New York

Please send your New Bulletin D-600 to the address below.

Name .....

Company .....

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Measure Motor Starting Currents

—*with this Ammeter*

THIS modified PY-5 instrument measures motor starting current—something new and exceptional which formerly could be accomplished only by means of an oscillograph—and its indication will be within 3 percent of the oscillograph's exact record.

To operate the new instrument is very simple. It is connected in the circuit like any other ammeter, but the reading is taken by the set and try method. The pointer is set to approximately the right position by means of the manually operated stop and the power turned on the motor. If the setting proves high or low the pointer is reset and a second trial is made. Final adjustment will be made in a few trials.

Special Features

Light Weight
Micarta Case
Sturdy Construction
Scale, 5½ inches
Aperiodically Damped
External Zero Adjustment.

After the reading is taken the stop can be returned to zero.

With the stop at zero the instrument will give readings as in any ammeter. Without changing connections from that used in measuring the starting current, the instrument will measure the locked-rotor and the running current. Such direct readings will be accurate within ½ of one percent.

We believe this is one of the most useful instruments a central station or industrial plant could own.

Consult the Instrument Specialist in the Westinghouse District Office near you.

Westinghouse Electric & Manufacturing Company
Newark Works Newark, N. J.
Sales Offices in All Principal Cities of the United States and Foreign Countries

Westinghouse

T 30523

What is communication worth to you?

WHEN floods or storms strike your territory—when you must get word out for help, or for the direction of line gangs—how much would reliable communication be worth in order to quickly get messages to their destination?

It is then that Westinghouse power line communication proves its worth. Steadily and unfalteringly messages come and go, sending help where it is needed, maintaining normal load conditions and keeping the entire power system under the dispatcher's control.

This system, which uses high frequency currents superimposed upon the power lines, is economical, complete and reliable. The equipment is manufactured in four types:

High power 250-watt sets for long distances

Low power 20-watt sets for short distances

Auto truck 20-watt sets for line-gangs

Portable sets for line patrolmen

Complete information is contained in Circular 1777-A and Reprints 349 and 350. Request your copies from the nearest Westinghouse office.

WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY
EAST PITTSBURGH PENNSYLVANIA
SALES OFFICES AND SERVICE SHOPS IN ALL PRINCIPAL CITIES

Westinghouse

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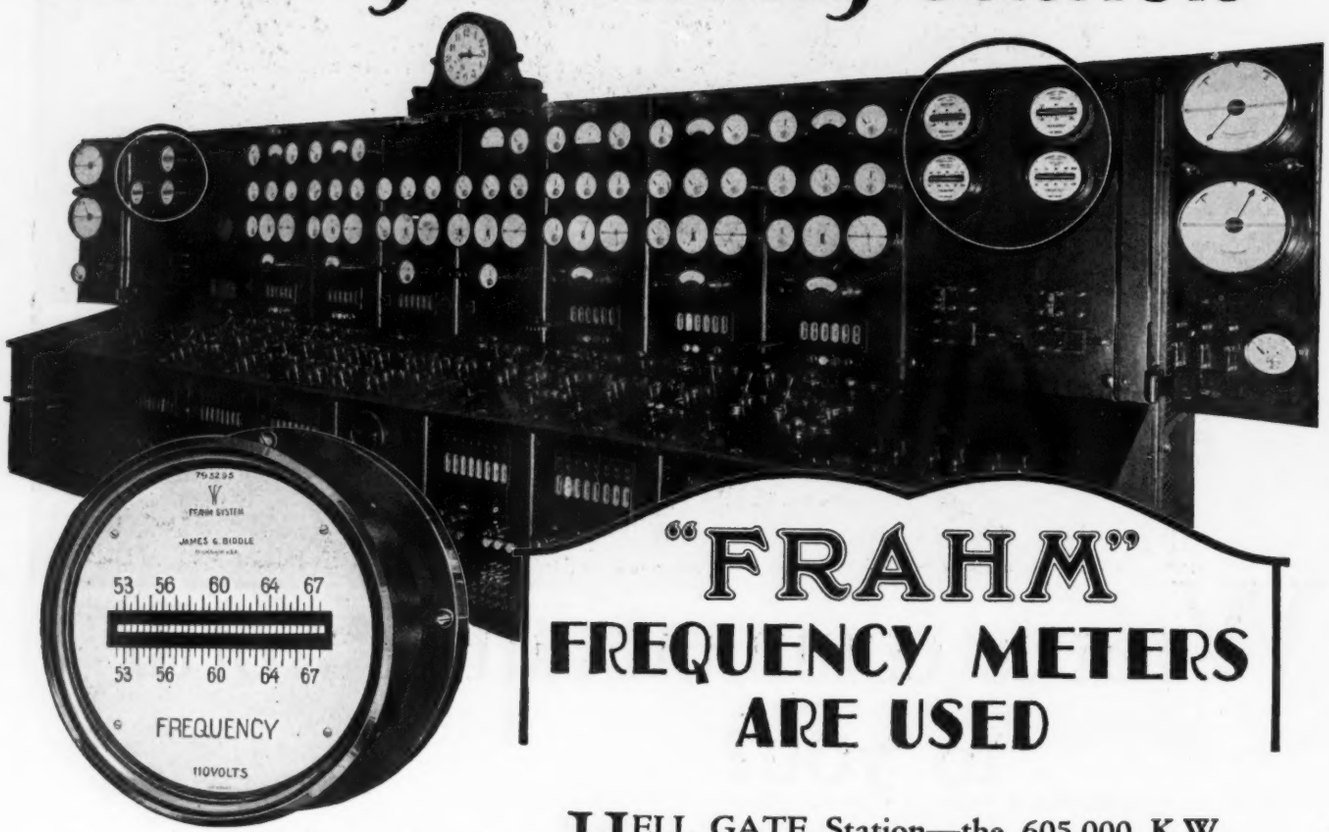
In the world's largest steam generating station-



"FRAHM" FREQUENCY METERS ARE USED

HELL GATE Station—the 605,000 K.W. plant of The United Electric Light and Power Company, New York City, is the world's largest steam generating station.

Frahm Vibrating-Reed Frequency Meters are installed on the high-tension control board under constant observation of the operators; and in addition, Frahm Vibrating-Reed Tachometers are installed on eight of the great turbo generators of this plant.

Frahm Vibrating-Reed Frequency Meters and Tachometers were selected for use in this world-famous station because they are highly dependable, easy to read and hold original calibration indefinitely.

Descriptive Bulletins 1170-W and 1240-W will be mailed on request.

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"MEGGER" & "BRIDGE-MEGGER" INSULATION TESTING SETS
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"FRAHM" FREQUENCY METERS
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"JAGABI" SPEED-MEASURING INSTRUMENTS
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120 V—640 A.H.
Philco Spray-Proof
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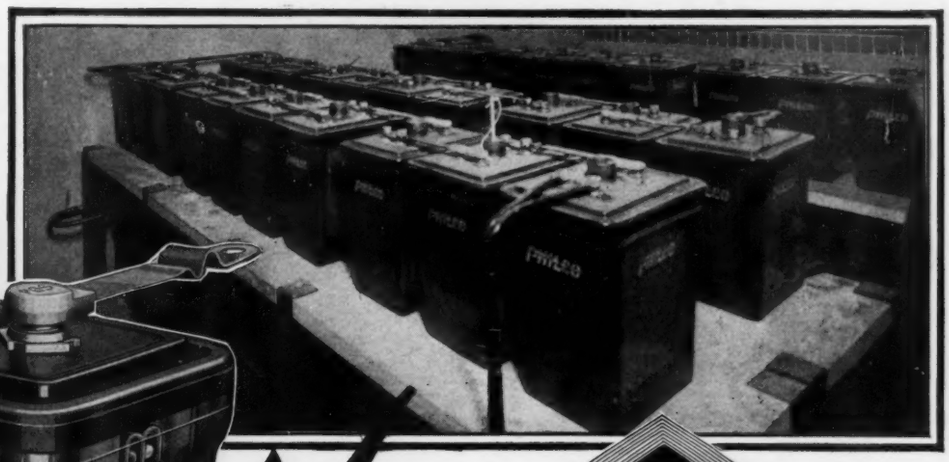

STEEL-GLASS

WHAT? A Philco developed pressed-molded jar of unequalled composition having a tensile strength of 5350 lbs. per square inch and a dielectric strength over 100,000 volts.

HOW? Under fire 120 hours at 2800° F. —pressed at 100 tons—electrically annealed in 5° steps from 1150° F. to room temperature over an 18 hour period—tested and retested.

WHY? (40-640 A.H.) Shipped fully charged —Freedom from breakage in installation and operation—PLUS—an element braced and rebraced by Diamond Grid Construction—THEN—SUPER-BRACED BY THE JAR ITSELF!

THE 11 POINTS TO PHILCO . . .

1. STEEL-GLASS
2. Corner and Side Locks.
3. Diamond Grids.
4. Philco Processed Plates.
5. Philco Slotted Retainers.
6. Quarter-Sawed Hardwood Separators.
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8. Built-in Charge Indicators and Thermometer.
9. Burned-Bolted Connectors.
10. Shipped Fully Charged.
11. Lowest Space Installation and Maintenance Cost.

WATCH THE 11 SUPERIORITY POINTS, M-O-N-T-H-B-Y-M-O-N-T-H

PHILCO
DIAMOND GRID
BATTERIES

Philadelphia Storage Battery Company, *Power Division:*
Ontario and C Streets, Philadelphia, Pa.

Please send me Bullein No. 956 describing in complete detail Philco Spray-Proof Power Batteries in Steel-Glass.

Name .....

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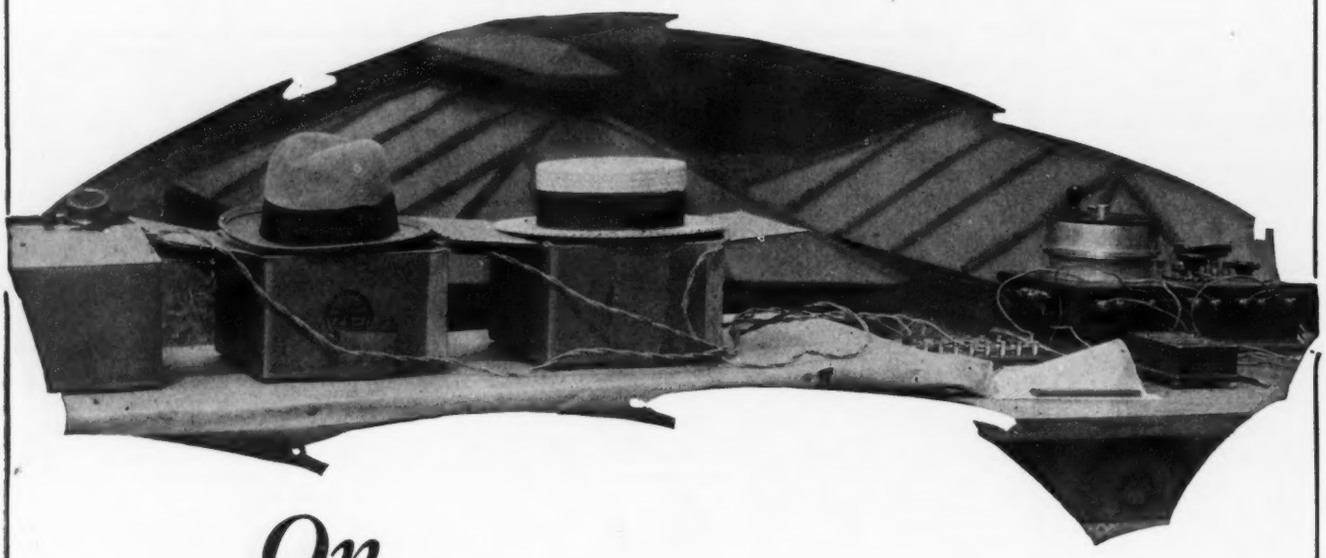
TUNE IN ON THE "PHILCO HOUR."



On Cool-headedness

Sometimes popular theory is proved right by test—though frequently it is the reverse.

Out of the hundreds of products that come to the chemical, mechanical, photometric and electrical departments of Electrical Testing Laboratories for test, some have wide popular interest.

A test for *The American Hatter* on the relative solar radiation of a felt hat and straw hat provides a timely one.

The solar radiometer indicated that the straw hat transmitted about 1/17th of the sun's radiant heat, and the felt hat 1/8th.

The test was conducted for the purpose of showing the public that the change to the straw hat in summer is a cool-headed move.

A fact they now
KNOW
—by test

KNOW —by Test

Electrical Testing Laboratories
80th Street and East End Ave.
New York ETL N.Y.

Thirty years in the Service of the Electrical Industry

The New G-E *Shading* Unit

With shield

WITH SHIELD (above) Used with the light shield, the G-E Novalux shading unit prevents light from striking nearby windows and porches.

Without shield

WITHOUT SHIELD (below) The G-E Novalux shading unit can be used without the light shield, like any other glassware.

Side and bottom views of globe with refractor and light shield installed. The rectangular shape has an important part in the prevention of shadows.

The light shield fastens to the upper globe fitter and shades the unit on the house side. However, sufficient light is diffused within the globe to illuminate the glass in back of the light shield. There are no shadows. In fact, the absence of bright light on the house front and lawn is the only visible evidence that a shield is used.

POWER companies can now make satisfactory adjustment of the frequent complaint, "that street light shines in our windows". The new G-E Novalux shading unit, with globe No. 162, is the answer to the problem if it involves a pendent fixture. If it is an ornamental upright fixture, the No. 161 globe is available. Either globe can be used with or without a refractor. For complete information, address the nearest G-E sales office.

720-127

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ELECTRICAL engineer for electrical construction supervisor on large project in New England. Should have five to eight years' experience, test room and construction work. Some design experience desirable. Give experience record, salary expected, whether married or single and enclose small photograph. P-175, Electrical World, Tenth Ave. at 36th Street, New York.

POWER sales engineer for New England, with knowledge of rates, steam and oil engines, industrial heating, and the application of motors and control. Write P-173, Electrical World, Tenth Ave. at 36th St., New York.

WANTED: Experienced and technically trained radio and electrical engineer, especially qualified for eliminating radio interference. Address Box 36, Bloomington, Ill.

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DRAFTSMAN, electrical, mechanical with experience in central station, distribution, substation, wiring diagrams and standards. PW-177, Electrical World, Tenth Ave. at 36th St., New York.

ELECTRICAL engineer, university graduate, 27 years, 6 years' experience in sub-station design, power plant reconstruction, automatic equipment, wiring and layouts, and underground circuits. Desires opportunity in subordinate or executive capacity. South, West or Southwest location preferred. PW-165, Electrical World, 520 No. Michigan Ave., Chicago, Ill.

ELECTRICAL ENGINEER—10 years' experience in engineering departments of large utility corporations—design, construction, maintenance and purchasing. Broad experience in transmission line construction and maintenance. PW-170, Electrical World, 520 No. Michigan Ave., Chicago, Ill.

ELECTRICAL engineer or executive position by a man with experience in steel mill, foundry, paper and pulp mill installations, also in the manufacture of welders, transformers, motors and generators. PW-182, Electrical World, Guardian Building, Cleveland, Ohio.

EXECUTIVE, electrical engineering and business administration training. Experience covers distribution, operation, installation. Administrative position in sales department of electrical manufacturer. Desire position with public utility, or manufacturing company. Married, age 37. PW-184, Electrical World, 520 No. Michigan Ave., Chicago, Ill.

POSITIONS WANTED

JUNIOR ENGINEER, 25, degree E.E., 1926, three years' experience in acceptance, maintenance, and general tests of various equipment and materials for large public utility, two years in supervisory capacity. Desires position in engineering, operation, or management of progressive company. Record and photograph forwarded. Now employed, available on three weeks. PW-180, Electrical World, Tenth Ave. at 36th Street, New York.

METER and instrument specialist, with 16 years' experience in A.C. and D.C. metering, laboratory and meter department work, supervising, testing and maintenance of instruments in power plants and sub-station and 2 years superintendent of meter department, desires position with responsibility and future. PW-178, Electrical World, Tenth Ave. at 36th St., New York.

METERMAN, practical and technical training in all watthour meters and switchboard instruments. PW-176, Electrical World, Tenth Ave. at 36th Street, New York.

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SALESMANAGER, competent, with years of experience as electrical salesman and as manager desires to change position. Fully qualified to direct sales force and sales policies. Complete references will be furnished as to past and present connections. PW-183, Electrical World, 520 No. Michigan Ave., Chicago, Ill.

WANTED: Work with some Eastern property, 6 years' experience with all kinds of substations indoor and out, including automatic rectifier stations acting in capacity of pusher on the job. At present employed. PW-179, Electrical World, Tenth Ave. at 36th Street, New York.

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The organization looking for this man is composed of people who can work with him. The job itself has been a stepping stone, one of our Vice-Presidents and one of our Division Managers having held it.

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10th Ave. at 36th St., New York

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2—300 kw., 125 v., 900 r.p.m. New G.E. Synchronous motor sets, 3 ph., 60 cy., 480-2300-4150 volts.
1—150 kw., 600 r.p.m., 250 v., Gen., 3 ph., 60 cy. 220-440 v., G.E. Synchronous motor.
1—125 kw., 250 v. Westinghouse Synchronous Gen. Motor Set, 3 ph. 60 cy. 230/2200 v.
1—100 kw., 125 v., D.C. 220-440 A.C., G.E. Synchronous Motor Generator Set. 220/440 v.
1—100 kw., 250 v., Gen., 900 r.p.m., 2200 Synchronous Motor.
1—85 kw., 250 v., 1200 r.p.m., 3 ph., 60 cy., 220-440 v., G. E. Synchronous Motor.
1—75 kw., 250 v., Generator, 3 ph., 60 cy., 2200 v., Synchronous Motor.
1—60 kw., 125 v., C.W., 3 ph., 60 cy., 220-440 v., Motor.
1—50 kw., 250 v., Westinghouse 3 ph., 60 cy., 220-440 v.
10-20-25-40 kw., 125 v., Exciter Sets.
10-20-30 kw. Balancer Sets.
3—5 kw. Battery Charging Sets.

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1—325 k.v.a.3 ph., 60 cy., 240-480 v.,G.E. Skinner Uniflow Engine Set.
1—150 k.v.a. G.E. Skinner Uniflow Set, 3 ph., 60 cy., 480-2300 v., 225 R.P.M.
1—75 k.v.a. 3 ph., 60 cy. Westinghouse Geared Non-Condensing Turbine.

TRANSFORMERS

1—4500 kva. 13,200-2300 volts, 3 phase, 60 cycle, G. E. Oil Cooled.
2—1500/3000 kva. G. E. combined oil and water cooled 3 ph., 60 cy., 11000-2200-2300 v.
2—1200 kva. 13,200-115/230/440 volts, G. E., 3 phase. Oil Cooled
3—150 kw., 4150 v., 120-240 Pittsburgh Oil Cooled Transformers.
15—5 kw., 30 kw., 3 ph., Pole Type, 2200-1100 440-220-110 G.E.

A. C. GENERATORS

No.	*Kw.*	*Rpm.*	*Volts*	*Ph.*	*Type*
1	400	360	480	3	G.E. "B"
2	300	1200	2300		Westg.
1	250	600	440	3	Westg.
2	125	900	2300	3	Cr.-Wh.
2	100	900	230/2300	3	G. E.
1	75	600	220	3	Westg.
1	75	900	2300	3	G. E.
1	50	1200	220–440	3	G. E.
1	50	1200	2300	3	G. E.
1	30	1200	220–2200	3	G. E.

MOTORS—3 Phase. 60 Cycle

No.	*Hp.*	*Rpm.*	*Volts*	*Type*
1	700	295	2200	G. E.
1	600	360	440	G. E.
3	450	1200	2300–4150	Westg. syn.
2	350	1200	2300-4150	Westg. syn.
2	300	600	445/2300	G. E syn.
1	250	600	220/440	Westg. syn.
1	250	600	440/2200	G. E. syn.
3	200	514	4150/2300	G. E. syn.
4	150	1200		Westg. sl. rg.
1	150	900	2300	G. E. syn.
2	150	514	2200	Westg. sl.rg.
1	150	1800	2200	Westg. sq.cg.mtr.
1	100	900	440/2200	G. E. sq. cg.
1	100	900	220/440/2200	Westg. sq. cg.
1	75	600	220	G. E. sq. cg.
1	75	600	220	Fair.-M. sl. rg.
1	75	490	440	Allis-Chal. sl. rg.
1	75	900	2200	G. E. Kt.
1	60	1200	220	G. E. sl. rg.
1	60	720	220/440	G. E. Kt.
1	60	300	220/440/2300	Fair.-M. syn.
1	50	600	2200	G. E. MT sl. rg.
1	50	900	2200	G. E. B.
1	50	1200	220/440	Wagner sl. rg
1	40	1700	220/440	Westg. sl. rg.
1	40	1200	220/440	G. E. KT.
1	25	900	440/2200	Cr.-Wheeler
1	25	1200	440	G. E. K.
1	25	900	220	Westg. C. S.

(2 Phase Motors on Request)

BRAND NEW MOTORS

No.	*Hp.*	*Rpm.*	*Volts*	*Type*
1	40	900	220–440	Gen. Electric KT
1	40	1200	220–440	Gen. Electric MT
2	30	1200	220–440	Gen. Electric KT
1	30	900	220–440	Gen. Electric KT
5	25	900	220–440	Gen. Electric KT
4	25	600	220–440	Gen. Electric KT
1	15	1200	220–440	Gen. Electric KT
2	15	1200	220–440	Gen. Electric MT
1	10	1200	220–440	Gen. Electric MT
5	7½	900	220–440	Gen. Electric MT

D C. Generators

No.	*Kw.*	*Rpm.*	*Volts*	*Type*
1	300	1200	125	brand new. G. E.
1	200	900	250	G. E.
1	200	600	250	G.E.
1	150	600	250	G. E.
2	150	1200	250	Westg., new
1	100	720	250	G. E.
1	75	450	250	Dieh l
1	50	600	250	Westg.
1	30	1000	250	Westg.

(Smaller Sizes on Request)

D. C. MOTORS—230 VOLT

No.	*Hp.*	*Rpm.*	*Type*
1	250	550	G. E.
1	150	600	G. E.
3	150	850	Westg. SK, new
1	150	1100	Westg. SK.
1	125	550	Cr.-Wheeler
1	100	625	Westg. Type S
1	80	500	Allis-Chal.
2	75	475	Westg. Type S
1	50	560	Westg. Sk
1	50	650	Sprague
1	40	400	Dieh l
1	40	1300	Dieh l
1	35	200	Dieh l
1	35	700	Cr.-Wheeler
1	35	420	Dieh l
1	20	665	Dieh l
1	20	200	Dieh l
1	20	900	Dieh l

(Smaller Sizes on Request)

D. C. MOTORS—125 VOLT

No.	*Hp.*	*Rpm.*	*Type*
1	125	575	G. E.
1	100	600	G. E.
1	80	600	G. E.
3	25	1200	Sprague
1	20	650	G. E.
1	15	775	SK Westg.

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Gregory Hi-Grade Rebuilt Motors do the job just as efficiently and satisfactorily as new motors and they cost much less.

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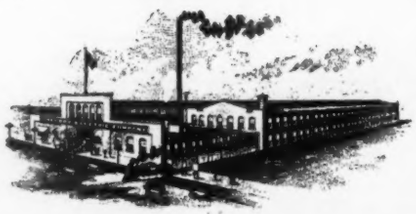

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200	Crocker-Wh. (motor only)	475	200	C.C.D.	600
60	Westghse.	920	220	S.	250
60	Diehl (motor only)	600-1000	220	K.	300
10	Sprague (motor only)	400-1200	220	L.C.	150
7½	G. E. (motor only)	500-1500	220	C.Q.C.	75
50	Sprague	650	110	D	250

Large stock of Motors from ½ to 300 hp. Also Generators and motor Generator Sets of all characteristics.

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Slip Ring Motors, 3 Ph., 60 Cy.

1—200-hp. Westing., Type CW, 220/440 volt, 514 r.p.m.
2—200-hp. Fairbanks-Morse, Type BV, 220/440 volt, 600 r.p.m.
2—150-hp. Gen. Elec. Type 1 Form M 220/440 volt 580 r.p.m.
1—104 hp. Gen. Elec. 1 Form M, 220/440 volt, 860 r.p.m.
1—100-hp. Burke Elec. Type EMV, 2200 volt, 900 r.p.m.
1—75-hp. Gen. Elec. Type MT, 220/440 volt, 860 r.p.m.

Synchronous Motor Generator Sets

5 New Westinghouse 3 Bearing, A.C., Type G, 50 Kva., 220 v., 3 ph., 60 cy., 1200 r.p.m., D.C., Type SK-150L, 125 volt.
2—Sets as Above Except D.C., SK-150, 250 volt.

See last week's listing

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HIGH GRADE STANDARD EQUIPMENT

Slip Ring Motors—3 Ph., 60 Cy.

Hp.	*Volts*	*Make*	*Speed*
400	2200-550	Whse.	450
225	220-440	G.E.	450
150	220-440	G.E.	720
150	220-440-550	G.E.	600
125	2200	G.E.	1200
125	220-440	G.E.	600
100	2200	G.E.	900
100	440-220	G.E.	720
100	440-220	G.E.	600
100	440-220	G.E.	900
75	220-440	G.E.	720
75	440-220	G.E.	900
75	550	G.E.	720
50	550	G.E.	514
50	220-440	G.E.	900

Synchronous Motors—3 Ph., 60 Cy.

Hp.	*Volts*	*Make*	*Speed*
240	2200-440	G.E.	720
135	2200-550	G.E.	900
80	2200-440-220	G.E.	1200
75	220-440	G.E.	900

Direct Current Motors

Hp.	*Volts*	*Speed*	*Make*	*Type*
225	230	760	Westghse.	SK
100	230	625	Westghse.	SK
60	230	1050	General Electric	RC
50	600	1450	Westghse.	SK

Direct Current Generators

200	250	850	Westghse.	SK
125	250	650	Western Electric	L
100	250	720	Westghse.	SK
75	250	850	General Electric	CLB
65	125	800	Westghse.	SK
35	125	850	General Electric	DLC
6	125	300	Westghse.	SK

Sq. Cage Motors—3 Ph., 60 Cy.

200	2200	Westghse.	600
150	2200	Westghse.	720
100	550	G.E.	1800
100	220-440	G.E.	1800
100	220-440	G.E.	900
75	220-440	G.E.	900
75	220-440	G.E.	720
75	220-440	G.E.	1200
75	2200	Allis-Chal.	1200

ENGINE GENERATOR SETS

1—250-kva., 480/240 v., 3-ph., 60-cy., 200-r.p.m. Crocker-Wheeler with Skinner Uniflow engine with all fittings. Practically new.

1—150-kva., 240/480 v., 3-ph., 60-cy., 257-r.p.m., Westinghouse with Erie-Ball simple engine.

Motor Generator Sets

1—200-kw., 250-v., 900-r.p.m. Westghse., SK connected to 2200-v., 3-ph., 60-cy., syn. motor.

1—100-kw., 125-v., 1200-r.p.m. G. E., type MPC D. C. Generator, connected to 125-kva. G. E., Type ATI. 440-220-v., 3-ph., 60-cy., syn. motor.

1—50-kw., 125-v., 1150-r.p.m. Wghse., f K, D. C Generator, connected to 75-hp. Wghse., type CS, 2200-v., 3-ph., 60-cy. motor.

A. C. Generators—3 Ph., 60 Cy.

1—187-kva., 720-r.p.m., 2200-440-220-v. G. E.

1—100-kw., 900-r.p.m., 2200-v. G. E.

1—75-kw., 900-r.p.m., 480-240-v. G. E.

1—75-kw., 1200-r.p.m., 2200-480-240-v. G. E.

1—37 ½-kva., 1200-r.p.m., 240-v., G. E.

Transformers

3—Allis-Chal. 667-kva., 60 cy., 13,800-230-460
3—G. E. 550-kva., 60 cy., 2300-230-460
3—G. E. 333-kva., 25 cy., 2300-230-115
3—G. E. 200-kva., 60 cy., 2300-230-115
2—G. E. 250-kva., 60 cy., 2300-230-460

STEPHEN HALL & CO., INC., 7th and Adams Sts., HOBOKEN, N. J.

Notice To Advertisers!

Owing to the Fourth of July, the *"Searchlight"* pages of the July 6 issue of

ELECTRICAL WORLD

will close one day in advance of the regular schedule.

Advertisers will be cooperating with us by sending new advertisements or changes of copy early.

FINAL CLOSING TIME
5 P.M. Monday, July 1st.

Watch—

the *Searchlight Section* for Equipment Opportunities

Electrical Machinery

Motors and Generators, A.C. and D.C. for sale at attractive prices. Large stock of New and Rebuilt Motors on hand at all times. Write for our Stock List and prices.

V. M. NUSSBAUM & CO., Fort Wayne, Ind.

Revolving Field Alternator

150 kva., 440 volt, 600 r.p.m., 3 phase, 60 cycle, belt driven with direct connected exciter. Entire machine in good condition. Must sacrifice because of change in power plant. Immediate delivery.

BENSON ELECTRIC COMPANY
Superior, Wisconsin

The Searchlight Advertising in This Paper

is read by men whose success depends upon thorough knowledge of means to an end—whether it be the securing of a good second-hand piece of apparatus at a moderate price, or an expert employee.

The Best Proof

of this is the variety of this journal's Searchlight ads. Without a constant and appreciable demand for such equipment or services, by its readers, the market-place which these advertisements represent could not exist for any length of time.

Are you using the Searchlight Section?

Synchronous Condensers

2000 kva., 3 phase, 60 cycle, 2300 volt, Westgh. with automatic regulating panels, motor operated rheostats, tirrel regulator.

1000 kva. 3 phase, 60 cycle, 2300 volt, Westgh. with automatic regulating panels, motor operated rheostats, tirrel regulator.

New Westgh. Synchronous Motors

3 Phase, 60 Cycle, 2300 and 440 and 220 Volts

In sizes from 125 to 575 hp., slow speeds, suitable for direct connection to air compressors, line shafts and to engines on generator ratings.

Transformers

Finest lot of transformers in the second hand market 1000 kva. to 1 kva. At savings worth while.

Street Lighting Transformers

A few left

3 Phase, 60 cycles, 2300 Volts, 6.6 amps.

A.C. Line Voltage Regulators

11½ to 22 kw., 2300 Volts, 3 Phase, 60 Cycles

Turbo Generators, Various Sizes. Also large stock Transformers, Engine Driven Units, Motor Generators, Motors, Dynamos of all Descriptions.

Send for Catalogue of the Largest Stock in America

George Sachsenmaier Co.
8401 Hegerman St., Holmesburg, Phila., Pa.

CONDENSER

1—Allis-Chalmers No. 5 High Vacuum Vertical Jet Condenser, with turbine, reduction gear and submerged type water removal pump. Capacity rating for 3,200 kw. turbine.

NASHVILLE INDUSTRIAL CORPORATION
Old Hickory, Tennessee

1500 KW., 1875 KVA. Turbo Unit

1—1500 KW., 1875 KVA. Westinghouse Double Flow 3600 r.p.m. Turbo Unit, 3 ph., 60 cy., 2300 v.; 200 lb. pressure with Alberger Jet Condensing equipment including turbine driven 12-in. Volute Pump; Dry Vacuum Pump; Panelboard with instruments. Perfect operating condition. Dismantled ready for immediate shipment.

200 KW. Duplex Motor Generator Exciter Set

Generator: 200 KW. self contained Westinghouse 125 v. 1600 amp. interpole type, 900 r.p.m.

Motor: 300 HP. Westinghouse CW slip ring, 3 ph., 60 cy., 2200 v., 900 r.p.m.

Turbine: Westinghouse 200 lb. steam pressure, 900 r.p.m., equipped with specially designed governor.

Starter: 300 HP. Westinghouse automatic A.C. controller, 3 ph., 60 cy., 2200 v., also circuit breaker. Equipment practically new, ready for instant shipment.

5240 G.P.M. Elliott-Erhart Vertical Jet Condenser

1—5240 G.P.M. Elliott-Erhart No. 9 Vertical Jet Condenser with centrifugal pump, 35-ft. head, direct connected to 200 HP. General Elec. type I form K, 3 ph., 60 cy., 2200 v., 48 amp. 875/900 r.p.m. including control apparatus. Formerly used with 3000 KW. Turbo Unit.

Send for Photographs and Prints.

No reasonable offers will be refused.

ARCHER & BALDWIN, Inc.

126 LIBERTY STREET, NEW YORK, N. Y.

Telephone RECTOR 4025-4026-4027

Business Wants

THE *Searchlight* Section of this paper represents a meeting place for men and concerns who have immediate business "wants" to fill—the section covers

Agencies Wanted	New Industries Wanted
Agents Wanted	Office Space for Rent or Wanted
Books and Periodicals	Partners Wanted
Business Opportunities	Patent Attorneys
Civil Service Opportunities	Patents for Sale
Contracts Wanted	Plants for Sale
Desk Room for Rent or Wanted	Positions Vacant
Educational	Positions Wanted
Employment Agencies	Property for Sale
Employment Service	Representatives Wanted
Foreign Business	Salesmen Available
For Exchange	Salesmen Wanted
For Rent	Spare Time Work Wanted
For Sale	Sub-Contracts Wanted
Franchises	Tutoring
Labor Bureaus	Vacation Work Wanted
Miscellaneous Wants	Work Wanted

"SEARCHLIGHT"

Attractive Price for QUICK SALE

12 Westinghouse 3 Phase Ground Detectors

Catalog Serial No. 183615

7 Westinghouse Ground Detectors No. 35586

These ground detectors are now in our warehouse in original containers — never having been unpacked. Write for prices.

CENTRAL LIGHT AND POWER COMPANY

Stores Dep't

San Antonio, Texas

Centrifugal Pumps

7—14-in. Worthington, motor driven, 8,500 g.p.m. at 152 ft.

6—16-in. Allis-Chalmers, Turbine driven, 8,500 g.p.m. at 90 ft.

2—14-in. Allis-Chalmers, Turbine driven, 6,500 g.p.m. at 150 ft.

5—8-in. Alberger Curtis, Turbine driven, 1,050 g.p.m. at 465 ft.

1—8-in. Hill Tripp, Motor driven, 1,200 g.p.m. at 120 ft.

2—5-in. Gould, Motor driven, 800 g.p.m. at 115 ft.

All practically new and ready for immediate service.

Nashville Industrial Corporation

Old Hickory, Tennessee

RANDLE

OFFERS BIG BARGAINS

IN

Used and Rebuilt Engine Generator Sets, Turbo Generator Sets, Motors, Rotary Converters, Generators, Motor Generator Sets, Engines, Boilers, Steam and Electric Machinery of all kinds, also Machine Tools. Send for our new machinery list. Yours for the asking. Established Over 50 Years.

The RANDLE MACHINERY CO.

1822 Powers St., Cincinnati, O.

FOR SALE, MAKE OFFER

Centrifugal Pump

1—De Laval, total head 130 ft., 3000 gallon per minute, Coupled to 150 HP G.E. form M, 3 phase, 25 cycle, 220 volt, 1460 r.p.m. motor on common base. No control. Good condition.

R. C. NILES, Jr.,

Consolidated Gas, Electric Light and Power Co. of Baltimore

Steam Turbines

6—300 H.P. Curtis Steam Turbines, Type L 25, 3-stage 2000 r.p.m., 150 lbs. steam pressure and 1 lb. back pressure.

4—181 H.P. Alberger-Curtis No. 361, single stage Steam Turbines, non-condensing type, 150 lbs. steam pressure, 1½ lb. back pressure, 1900 r.p.m.

6—225 H.P. Moore, Multi-stage Steam Turbines, non-condensing type, direct connected to reduction gear, ratio 3600 to 970 r.p.m.

Priced low for quick sale.

Nashville Industrial Corporation

Old Hickory, Tennessee

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For every business want

CLASSIFIED ADVERTISING

EMPLOYMENT—OPPORTUNITIES—EQUIPMENT

think SEARCHLIGHT first

THE classified advertising pages of ELECTRICAL WORLD offer you a direct, quick acting, and economical way of getting into contact with the men and concerns in the electrical industry. Based on many years' experience with classified advertising in fifteen publications, serving eight of this country's major industries, the "Searchlight" Classified Advertising Service is complete in every detail.

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For Exchange
For Rent
For Sale
Franchises
Industrial Sites
Labor Bureaus
Miscellaneous Wants
New Industries Wanted
Office Space for Rent or Wanted
Partners Wanted
Patent Attorneys
Patents for Sale
Plants for Sale
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Positions Wanted
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Used and Second Hand Machinery
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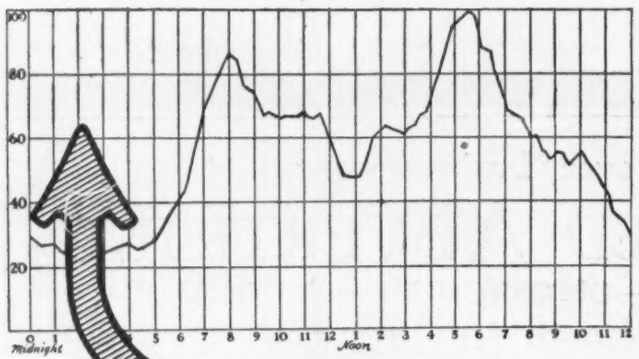
If there is anything you need now—a plant, a man, a machine—if there is anything you want to sell—a patent, a complete business, a factory site—just write a letter today to the Searchlight Department.

All inquiries answered promptly.

Address

SEARCHLIGHT DEPT.

Tenth Ave. at 36th St., New York City



SAUTER
TIME SWITCHES
lead in off-peak service

OFF-PEAK or two-rate metering wherein a power company sells power to consumers during the low-demand night hours at lower rates is now engaging the attention of forward-looking power men.

The merits of such service depends largely in keeping trouble calls few and far between particularly on residential loads. The necessity for installing trouble-free time switches becomes obvious.

There are more Sauter Time Switches in this service throughout the World than any other—a strong indication of the acceptance by power men of the dependability and low up-keep of Sauter devices.

We welcome the opportunity of discussing with you the exact type of Sauter Time Switch for home or factory off-peak service or for many of the applications to Central Station problems.

Thermostatic Control—

is applicable to all Sauter self-wound Time Switches and serves to open circuit to hot water heaters when temperature of water reaches a predetermined sufficiently high value.

R. W. Cramer & Co., Inc.
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TRADE
ELECTROSE
MARK
REG. U.S. PAT. OFF. & FOREIGN COUNTRIES

READY to serve you in our new plant with 50% greater floor space and the same high standards we have always maintained.

We can supply your demands for "Electrose," "Bakelite" and "Insulate" products. Send us your specifications.

Quotation cheerfully and promptly given.

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and
GENERAL INSULATE CO., Inc.
New York Ave. & Herkimer St., BROOKLYN, N. Y.

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NEW EDITION
of the
Industry's Catalogs

1929
ELECTRICAL ENGINEERING CATALOGS

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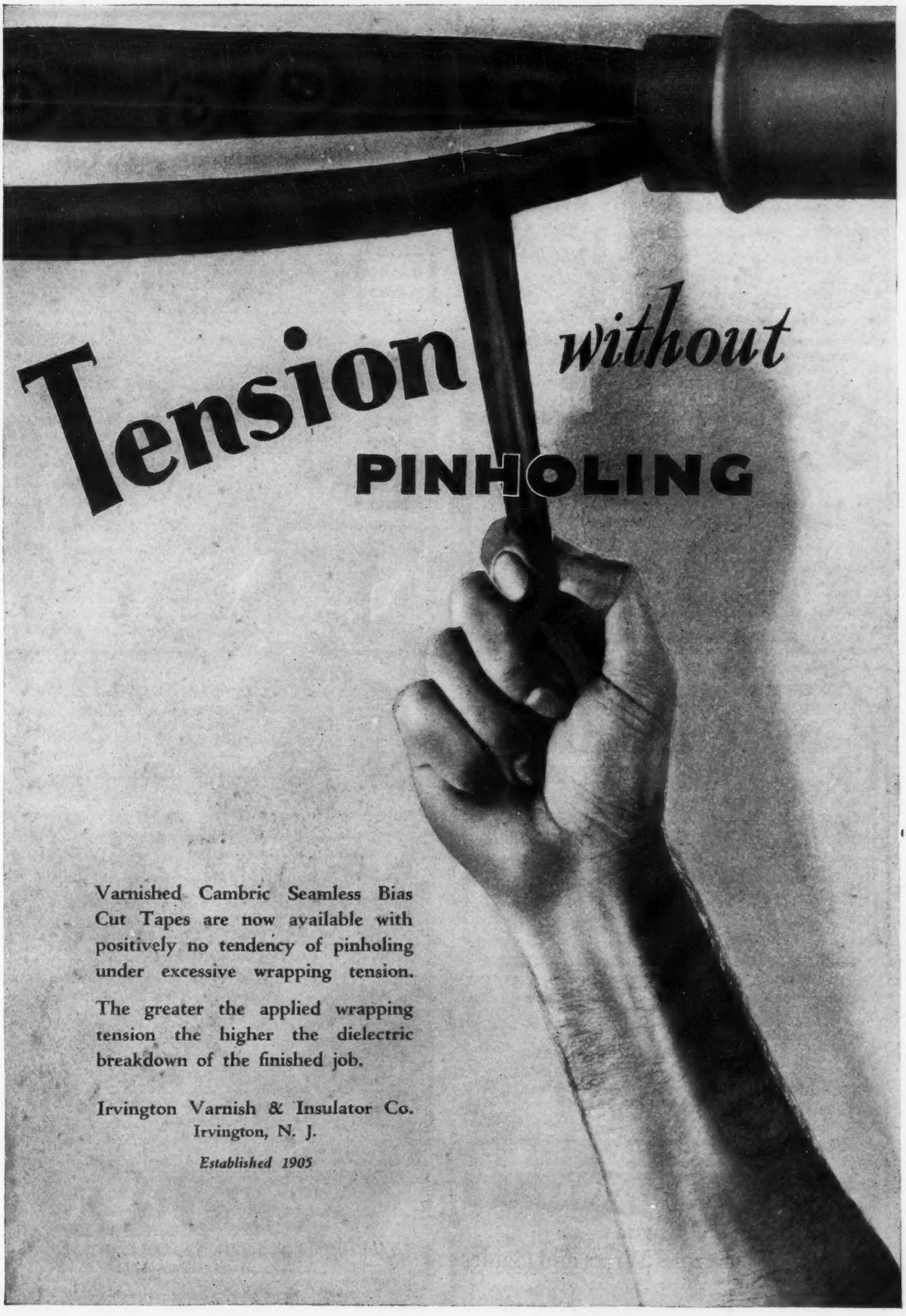

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The greater the applied wrapping tension the higher the dielectric breakdown of the finished job.

Irvington Varnish & Insulator Co.
Irvington, N. J.

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CLEAN INSIDE—Made in our own open hearth furnaces, using the latest and most progressive methods to get good clean steel.

CLEAN OUTSIDE—Rolled and treated with utmost care to obtain high quality and uniformity in all respects.

RESULTS—Better magnetic performance, best die service.

Empire Steel Corporation, Mansfield, O.

Successors to the Mansfield Sheet & Tin Plate Co.

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EST. 1865 AIMCo INC. 1918

"American" INSULATING MACHINERY COMPANY

REG. U.S. PAT. OFF.

519 Huntingdon St.
PHILADELPHIA PENNSYLVANIA U.S.A.

MACHINES FOR

DRAWING
RESPOOLING
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ENAMELING
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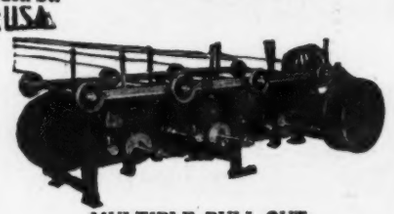

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With TRAVERSE for 8 Reels.
Has 8 Independently Operated
FRICTION CLUTCHES

Monson Slate

For High Grade
Electrical Equipment

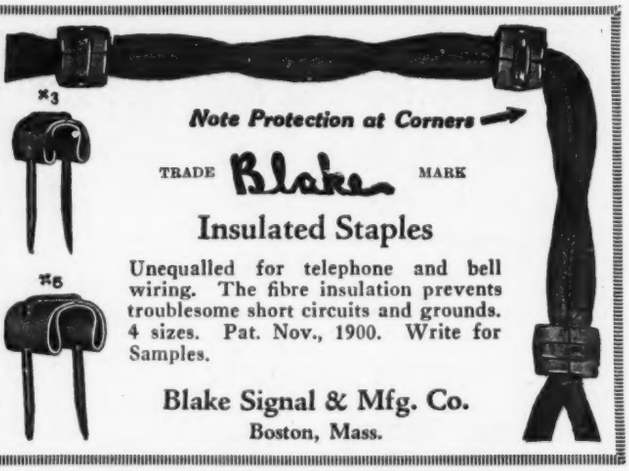
For Switchboards, circuit breakers, compensators and similar electrical equipment Monson Slate is recognized as the best.

We have just completed additions to our producing facilities which provide for double our former capacity. Thus manufacturers of electrical apparatus are assured prompt attention and quick shipments.

Write us your needs NOW

Portland-Monson Slate Company

Portland, Me. *Quarries* at Monson, Me.



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Insulated Staples

Unequalled for telephone and bell wiring. The fibre insulation prevents troublesome short circuits and grounds. 4 sizes. Pat. Nov., 1900. Write for Samples.

Blake Signal & Mfg. Co.

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Made for Your Particular Requirements

Are you interested in securing sheets distinctive for uniformity, low core losses, high permeability and exceptional punching qualities?

We maintain, at your service, a highly specialized department for the production and betterment of Electrical Steel sheets. Submit Your Inquiries

THE NEWPORT ROLLING MILL CO.
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"GUMMON" is the standard and original Cold Molded Insulation, made by the oldest and largest producer. Continuously improved to meet increasingly exacting requirements.

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For Electrical Specialties

IMPERIAL PORCELAIN WORKS
TRENTON, N. J.

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THE MATERIAL OF A THOUSAND USES

Molding Materials; Laminated Sheets, Tubes and Rods; Lacquers, Varnishes and Cements.

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A Superior Insulation

Strong, Accurate, Everlasting

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Electrical Wires and Cables

John A. Roebling's Sons Co., Trenton, N. J.

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CGW

INDUSTRIAL WARE

A Product of Corning Glass Works

Write for literature. Corning Glass Works, Dept. 62, Industrial and Laboratory Division, Corning, N. Y.

A clock just as smart looking as it is accurate... DUREZ *helped make it so!*

IT'S AN electric clock. The Poole Clock, made by the Morse Chain Company, Ithaca, N. Y. A small electric flashlight battery keeps it going for a year at a time. And that clock—that *smart-looking* clock—tells time accurately! They used Durez!

They used Durez for the base. They used Durez for the battery container. Both have a rich mahogany effect, polished and smooth as ivory. Durez did that. But Durez did more. These parts are tough, hard, non-brittle. Never affected by warping or splitting, nor by changes in atmosphere or moisture. Nothing to go wrong. As carefully designed, as accurately constructed, as this fine clock itself! Durez did that, too!

The Durez parts came out of the mold finished. There was no lathing, no turning. No surfacing to be done; no burnishing or smoothing. All intricate designing was cared for—grooves, patterns, lettering, holes; the inserts were a part of the molding process; and there was just one operation! Finished! Nothing more to do. And every one of a million more would look exactly the same.

***Your* product can be made just as easily. *Your* product can have the same smart, modern appearance, the same accuracy. Durez comes in a wide range of practical colors. You can use them straight. Or they can be blended, pebbled, striated. Does your product need this beauty? Are you losing out to your competitor merely because his product looks better than yours? Then you should use Durez!**

Investigate this remarkable basic formula material. Let us show you how durable it will make your product, how efficient, how beautiful! Write today for information. General Plastics, Inc., 67 Walck Road, North Tonawanda, N. Y. Also New York, Chicago, San Francisco, Los Angeles.

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Write for this free booklet—"Do It With Durez." Contains complete information about Durez—physical and dielectric properties, color ranges, and scores of possible applications.

They Speak For Themselves!

Made from Wild Brazilian Rubber with a pure gum center and a specially compounded outer surface, Wilson's Linemen's Gloves speak for themselves in durability, unusual di-electric strength, and pliability.

Send your company requisition for a sample pair gratis. Let Wilson performance prove Wilson superiority.

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Guaranteed under A.S.T.M. Specifications

"Specialists In Rubber Gloves and the World's Largest Exclusive Manufacturers."

"HI-TEST" Guaranteed to 10,000 volts

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Long Life
Never Fade
Cost Less
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PORCELAIN ENAMELED IRON

Here is a source of supply you can depend on. Make a note of it and place in your files for quick reference. Signs made to specifications of Power Companies. Send blue prints or specifications for quotations.

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CANADIAN PORCELAIN CO., LTD.,

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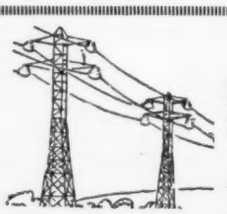
Specializing

High and Low Voltage Insulators



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We have the largest hot dip job galvanizing plant and kettles in the United States.

We have the most modern equipment to do first class galvanizing at lowest prices. Send prints.

Galvanized products furnished.

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Write for catalog and estimates

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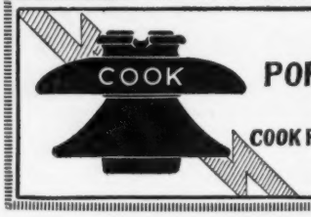
NORTHERN **CEDAR POLES** WESTERN

BUTT TREATING ANY KIND REQUIRED

BELL LUMBER & POLE CO., *Minneapolis, Minn.*



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PORCELAIN INSULATORS
A QUALITY PRODUCT
COOK PORCELAIN INSULATOR CORP.
CAMBRIDGE, OHIO.

Paragon Grounds

Furnish permanent, effective grounding protection.

Heavy continuous copper throughout. All joints spot welded. Insure durability, highest conductivity, lowest resistance to ground, and ample capacity. Inexpensive and easily installed with a post hole auger.

Write for descriptive literature.

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The Correct Design

The Porcelain Insulator Corp.
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Simplex Jacks

for Industries · Utilities · Railways · Oil Wells
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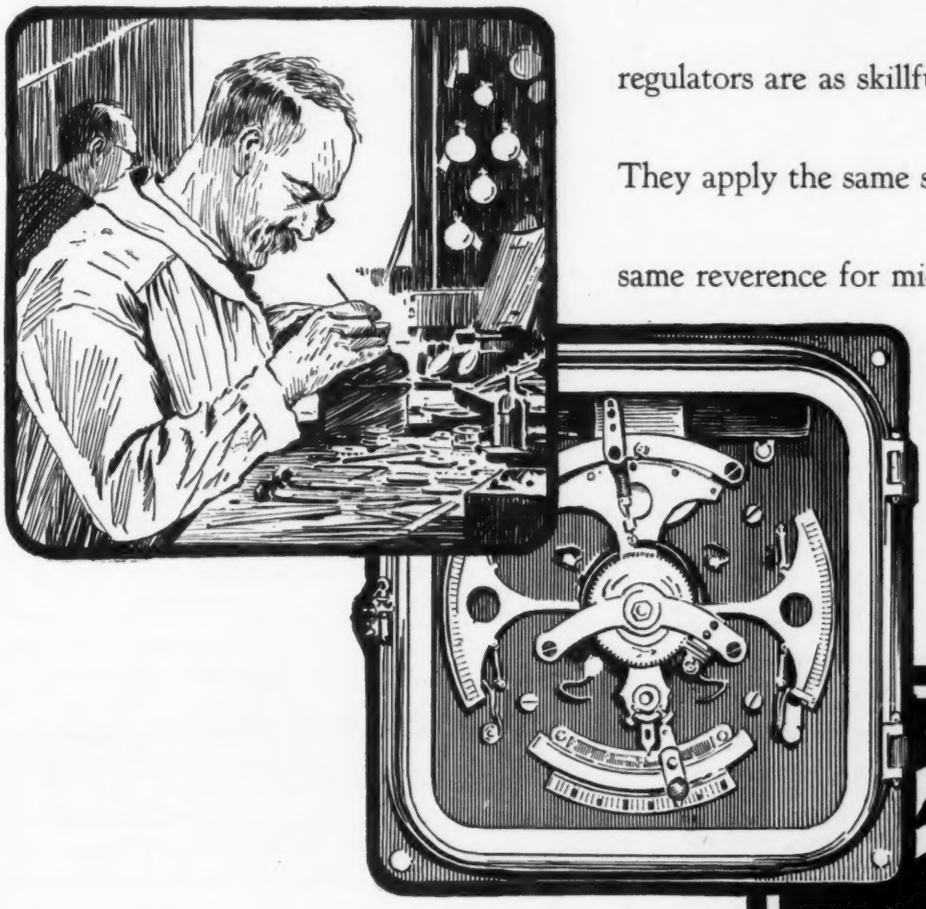
Built as accurately as a fine watch

The men who build A. B. B. automatic voltage regulators are as skillful as expert watchmakers. They apply the same standards of precision, the same reverence for microscopic accuracy.

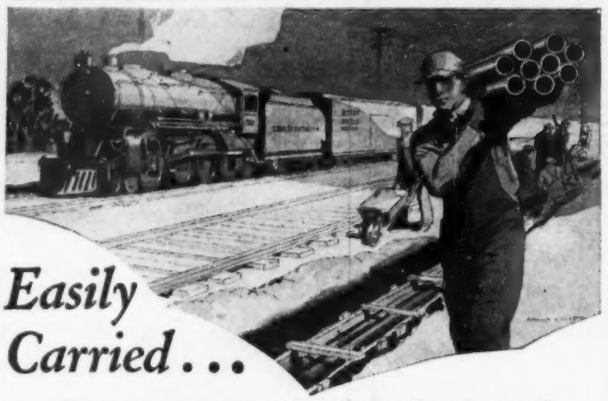


As a result, A. B. B. automatic voltage regulators operate as silently as any watch and need no more attention. Washing the window once a year is just about all the maintenance that is ever required.

AMERICAN BROWN BOVERI CO., INC.
CAMDEN, N. J.

AMERICAN BROWN BOVERI

ORANGEBURG FIBRE CONDUIT



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IT is often necessary to lay cableways through a rough terrain, as along a railroad right of way. Under such conditions the uniform five-foot lengths of Orangeburg Fibre Conduit make handling easier, and hence cheaper.

Every piece of Orangeburg Fibre Conduit is without the interior flaws which may so easily cause serious damage when cables are being drawn into place.

The diameter of each piece is the same throughout. Orangeburg Fibre Conduit assures cableways which are satisfactory to use under every condition which must be met in underground work no matter how unusual or difficult.

For 36 years Orangeburg Fibre Conduit has been the choice of public utility companies, municipalities and governments all over the world. No other fibre conduit has any such history of success. We are ready to supply any details, or to make suggestions concerning underground cableways.

The Fibre Conduit Co.

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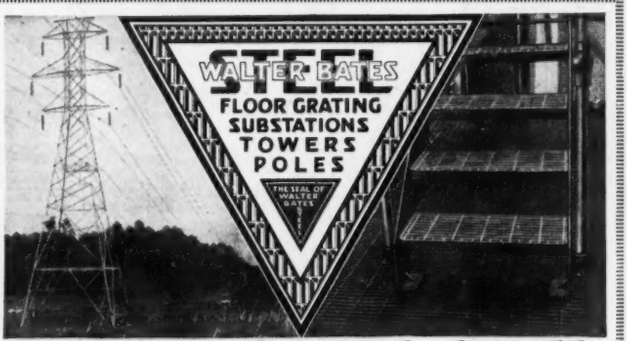
Switching Equipment for Manual and Motor Operation
Outdoor Substations
Bus Supports, Choke Coils for Indoor and Outdoor Service
Switchboard Fittings
Copper Fittings
Control Switches

for the good of the Service

ELPEQ

ELECTRIC POWER EQUIPMENT CORP.
412-20 N. 18th St., Philadelphia, Pa.



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GARY INDIANA.

TIREX CABLE for electric shovels and other equipment

TIREX cable for electric shovels, welders, dredges, conveyors, etc. gives dependable service and long life.

Simplex Wire & Cable Co.

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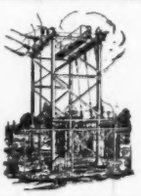
201 DEVONSHIRE ST., BOSTON
BRANCH SALES OFFICES
CHICAGO, 564 W. Monroe St. SAN FRANCISCO, 390 Fourth St.
NEW YORK, 1328 Broadway CLEVELAND, 2019 Union Trust Bldg.
JACKSONVILLE, 1010 Barnett Nat'l Bank Bldg.



Switches—Arresters—Fuses—Sub-Station Equipment

HI-VOLTAGE Equipment Company
Cleveland

OFFICE AND FACTORY
3208 CROTON AVENUE

Steel Transmission Towers
and Special Structures
Substation Structures

ARCHBOLD-BRADY CO.
Engineers and Contractors SYRACUSE, N. Y.

Crystal Valve Lightning Arresters
The outstanding development in lightning protective apparatus.

ELECTRIC SERVICE SUPPLIES CO.
17th & Cambria Sts., PHILADELPHIA; 111 N. Canal St., CHICAGO; 50 Church St., NEW YORK; Lyman Tube & Supply Company, Ltd., Montreal, Toronto, Vancouver.

Non-Rusting Ground Rods Wire Strand

"COPPERWELD"
COPPERWELD STEEL CO., GLASSPORT, PENNA.
Made by the Molten Welding Process

RUGGED DISC INSULATORS

"PROTECT WITH JD TO A GREATER DEGREE"

JEFFERY-DEWITT INSULATOR CO. KENOVA, W. VA. U.S.A.

THICKER PORCELAIN FOR POWER TRANSMISSION SERVICE.

Steel Transmission Towers

RITER-CONLEY COMPANY
Pittsburgh

TO MEET THE NEW TEMPO OF MODERN BUSINESS

THE McGRAW-HILL PUBLISHING COMPANY

ANNOUNCES THAT

THE MAGAZINE OF BUSINESS

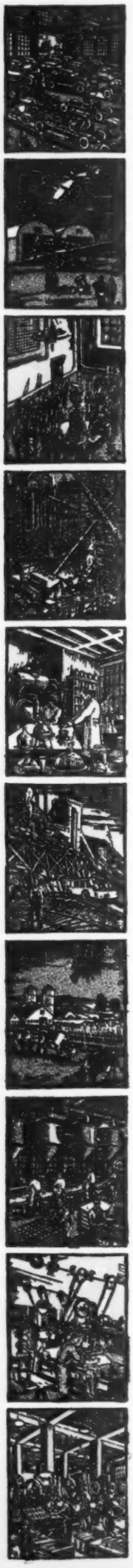
WILL HEREAFTER BE PUBLISHED WEEKLY
UNDER THE TITLE OF

THE BUSINESS WEEK

A Journal of Business News and Interpretation

BEGINNING WITH THE ISSUE OF

SEPTEMBER 7TH, 1929



THE BUSINESS WEEK

A Journal of Business News and Interpretation

"ACCELERATION, *rather than structural change, is the key to an understanding of our recent economic developments. Gradually the fact emerges . . . that the distinctive character of the years from 1922 to 1929 owes less to fundamental change than to intensive activity . . . Changes have not been in structure but in spread and speed.*"

—from the Report of the President's Committee on Recent Economic Changes.

SPREAD and speed!

How fast has grown the pace of business in the brief span of only three business generations!

In the 1870's the business man came down to his office and started the day by calling his employees, as he could call his customers, by name.

Business was *local*. The business man had immediate and firm control of his business operations—of his employees, his materials and his markets. Rare were the outside influences that touched the conduct of his business.

In Washington, there were only the makers of the tariff. His competition was the store across the street, the factory across the river; his markets were stable, steady. Of labor difficulties he had none; his machines were few and simple, and he knew all that were of use. What went on in the next state or in another industry was of no moment. Business enjoyed a self sufficiency that it will never know again.

◆ ◆ ◆

Consider, then, how vast have been the changes in sixty years: Quantity production, bringing new problems in manufacturing and marketing . . . The new importance of color and design . . . Mass distribution . . . Chain stores . . . Transportation and communication speeding up the pace of business . . . New conditions of competition . . . The new influence of government at Washington and the State Capitals . . . The new financial structure with vast trading on the exchanges and a widespread ownership of vast corporations . . . Most important of all, research . . . creating new industries—the automobile, the movie, rayon—destroying old ones . . . releasing thousands of workmen here . . . finding new tasks for them and for thousands more . . . Everywhere are new forces touching the conduct of business.

So complex have become the ramifications of business that to-day it has come to be the very essential of business management to have—*a knowledge of the news.*

The collapse of the wheat market in Chicago is not a local affair nowadays. It is not even a western matter. It has its repercussions in Wall Street. It has its meaning to the radio industry . . . It may hurt the silk importer . . . help the rayon mill.

A bank failure in Germany means something to-day to the hardware manufacturer in New Britain . . . It may well happen that

it will mean more than the crash of a bank at home.

◆ ◆ ◆

Observe how great has been the development in publishing for the business man—

A knowledge of happenings and developments within his trade, profession or industry has been so essential as to create a group of industrial, engineering and trade papers of paramount importance to the conduct of American business—providing the business man with an accurate knowledge of material supply, engineering and manufacturing methods, marketing conditions, sales methods, store, office and plant management.

Even the daily newspaper has expanded its business news to the point where it devotes entire sections to the daily news of business.

And yet, with the expanding need of business for facts,—for news,—there is still no single publication that provides the business man with a timely, complete and accurate record and interpretation of the news that touches the conduct of business.

The man who reads the daily newspaper, his trade or industry paper, and the business journals is still without that master-key to the news that he so badly needs in the fast-paced tempo of present-day business.

Over a period of years the McGraw-Hill Publishing Company has been observing and analyzing this condition, studying this growing problem of modern business. The first step was the acquisition of The Magazine of Business; the second, a systematic survey of the business man's need for news; the third, an analysis and organization of the sources of news. Now, the final step: The transformation of The Magazine of Business into The Business Week.

The Business Week with its appearance next September, the only business weekly of general interest, is the answer to the new compulsions of *Spread and Speed.*

◆ ◆ ◆

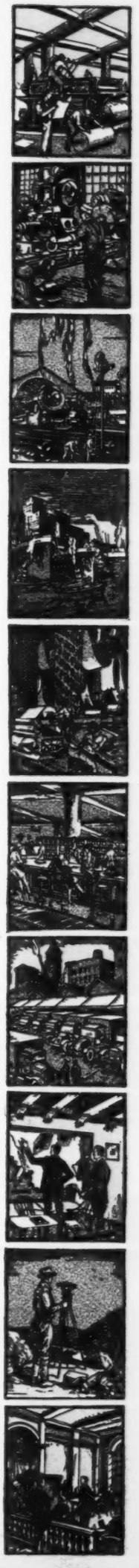
The Business Week will be operated so close to the news that the business world will get the news that counts while it is still hot; but it will be sufficiently *after the event* to enable the editors of The Business Week to clothe the facts with their full significance.

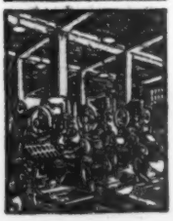
The Business Week will be generously staffed editorially. Trained news gatherers, able and experienced feature writers, economists and statisticians, will so co-ordinate the gathering of the facts and their presentation and interpretation that The Business Week will point straight to the news and its significance—and to the outlook for business.

The result, we are confident, with the co-operation of the McGraw-Hill staff of 128 editors, with the vast editorial resources which 26 McGraw-Hill Publications make available, will be to present to American business a journal of business news and interpretation not available from any other publishing source.

◆ ◆ ◆

The Business Week will be preeminently the business man's journal of business news, vital and vivacious, informative and dynamic, with something American in its every characteristic. It will be keyed to the spirit of the new tempo in American business.





IN CLOSER FOCUS

THE week by week contents of the Business Week will include these features and departments—

The News Interpreted: The introductory section of The Business Week will present the looming features in the news of the week; will discuss and interpret them with authority; with a style that will be alert, crisp, pithy.

It will highlight the outstanding news in a way to point its meaning for the man who must decide the policy of a business institution.

The Business Outlook: Business conditions in all industries and all sections, from the textiles of the North to the canneries of the far West, from the stores of Michigan Avenue to the docks of New Orleans, will be reviewed, checked up, co-ordinated, digested; so that the business man may have at hand each week a timely and brief insight into the trend of business,—may have an answer to his constant but unspoken speculation, "What's next?"

The Week in Washington: What is going on in Washington has much to do to-day with what is done in Detroit and Atlanta. And the National Capital will be thoroughly covered each week by the Washington Editor of The Business Week.

What is Happening in Business: The staff of The Business Week will be in touch with all the fields of business. Significant developments in every department of business—production, sales, management, and all the rest —will be reviewed, clearly and concisely.

Special Articles: Every week there are business developments so freighted with importance to the future of American industry and commerce that they demand special and extended attention. The Business Week will go direct to the fountain head for light on such news. It will present interviews with the great business men of the world who *make* the news. It will offer articles by them on the topics of pressing, immediate interest.

Editorial Leadership: The Business Week, dedicated to the conviction that the great new opportunities of business carry with them corresponding responsibilities upon the business man, will discuss and interpret the conduct of business with vigorous editorials.

It will stand always for the highest ideals of American business—a fair deal for business from government and the public; a fair deal from business for the consumer, the worker and the competitor.

The Business Week will have personality, convictions, a point of view. You may not always agree with its views; you will respect them and find them interesting.

Business in Its Human Phase: Because business is a very humanly interesting thing to business men, the trivial and the oddities, the side-lights and the cross-currents, the ingenious by-plays that make business a warm and fascinating subject—and an altogether human one—will be reflected and reported in The Business Week.

◆ ◆ ◆

In quality and appearance The Business Week will maintain the highest standards.

The size of the magazine will be 8¼ by 11⅛ inches; the size of the type page, 7 by 10⅜ inches. There will be three columns, 429 lines to the page.

The inside pages will be printed on book paper of the finest grade and exceptional weight. The covers will be 110 pound coated of the first grade; printed in color. The binding will be saddle-stitched.

There will be 28 pages—or more—of editorial text; the typography will be characterized by simplicity, spirit and readability. Illustrations will be both photographs and original drawings. There will be original cartoons.

Editorial forms will close Wednesday night. The issue, dated Saturday, will be on the newsstands Friday morning.

Final advertising forms will close on Friday of the week preceding publication—meaning a margin of only one week between the receipt of advertising plates and distribution to the reader.

The Business Week will be priced at 15c the copy; by subscription $5 the year.

The advertising rate will be $600 the page; the agency commission 15 per cent; the cash discount two per cent.

The circulation at the outset will be 75,000, net paid, A.B.C.

McGRAW-HILL PUBLISHING CO., INC.

NEW YORK CHICAGO SAN FRANCISCO
BOSTON DETROIT ST. LOUIS
PHILADELPHIA CLEVELAND GREENVILLE
LONDON WASHINGTON

A New FIRST AID Catalog!

Free
FOR THE ASKING

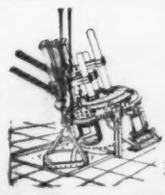
Send today for your copy of this 32 page Catalog of First Aid Materials which lists hundreds of items, with numerous illustrations of the latest developments for the treatment of injuries.

Mine Safety Appliances Co.
Braddock, Thomas and Meade, Pittsburgh, Pa.

"EVERYTHING FOR MINE AND INDUSTRIAL SAFETY"

SAFETY SWITCHES
Accessible Main Fuse
30 to 600 amps.
30 to 400 amps.
Remote Control
& Automatic Transfer Switches
PALMER ELEC. & MFG. CO.
WALTHAM, MASS.

WEATHERPROOF
RUBBER COVERED
SLOW BURNING
BARE COPPER WIRE
PHILLIPS WIRE COMPANY
Division of General Cable Corporation
PAWTUCKET, R. I.



Moore Rapid Lectromelt Furnaces
Ten Standard Sizes ½ to 24 Tons Capacity
Most Rapid and efficient for making
Tool Steels, Alloy Steels, Forging Steels
Steel Castings, Malleable Iron, Grey Iron
Carbide, Ferro-Alloys etc.
PITTSBURGH ELECTRIC FURNACE CORPORATION
P.O. Box 1125. PITTSBURGH, PA.

Lapp Insulators
Lapp Insulator Co. Inc. LeRoy N.Y.
Trade Mark

Crapo
GALVANIZED PRODUCTS

The pure zinc coating on *Crapo* Galvanized Telephone Wire and Strand is *non-peeling, non-cracking.* Even when subjected to splicing, twisting or bending, this protective coating remains uninjured.

That is why *Crapo* Galvanized Products are outlasting all others in actual service. That is why users, year after year, are reducing maintenance costs to new low levels....

Crapo Galvanized Telephone Wire and Strand can be obtained from representative Jobbers. Insist upon *Crapo* quality! You can identify it by the *Crapo* Tag....

Indiana Steel & Wire Co.,
Muncie, Indiana

AMERICAN ENGINEERING COMPANY, PHILADELPHIA
AMERICAN ENGINEERING COMPANY, PHILADELPHIA
TAYLOR STOKERS IN PLANTS
AMERICAN ENGINEERING COMPANY, PHILADELPHIA
TAYLOR STOKERS AT LORAIN STATION, OHIO PUBLIC SERVICE COMPANY
AMERICAN ENGINEERING COMPANY, PHILADELPHIA
AMERICAN ENGINEERING COMPANY, PHILADELPHIA
TAYLOR STOKERS IN AN INDUSTRIAL PLANT
APANY, PHILADELPHIA
th TAYLOR STOKERS
al Power Plants

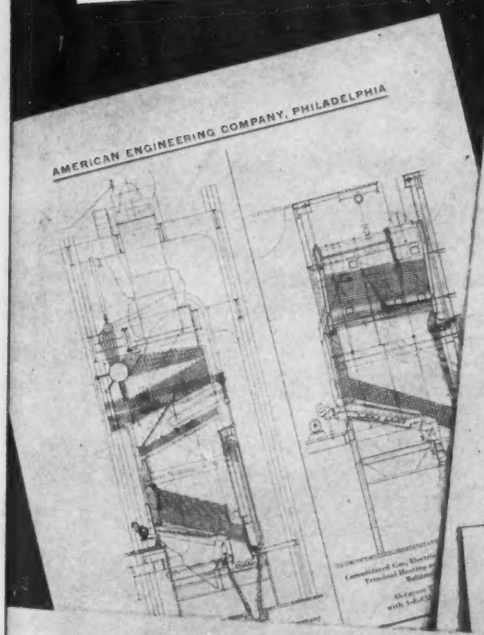
If you are interested in the

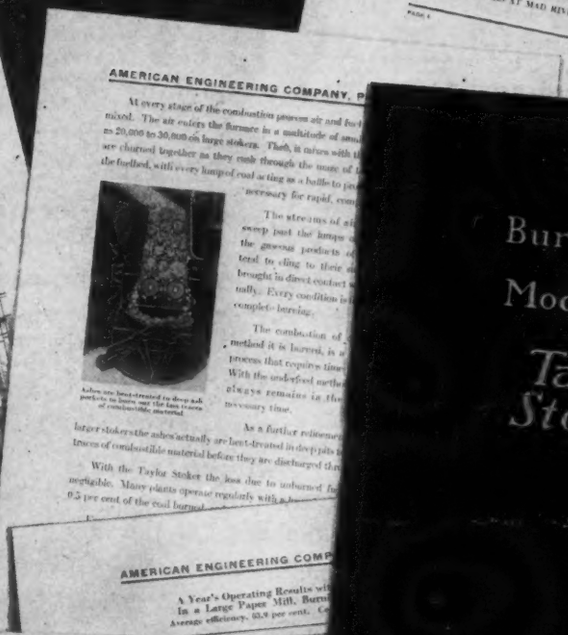
Cost of Steam

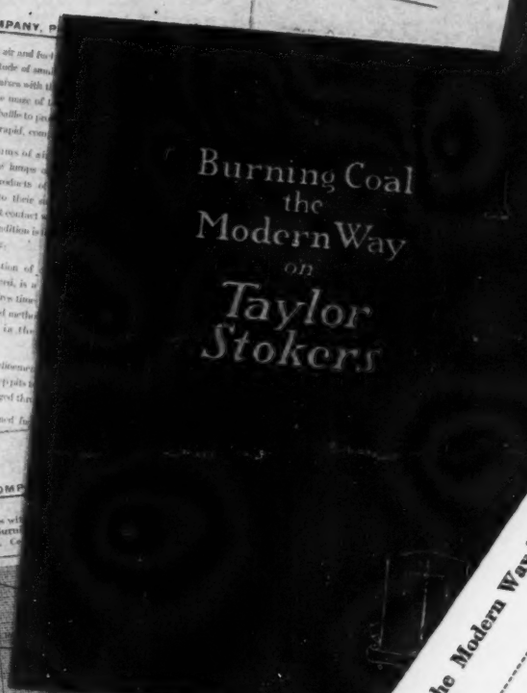
send for this profusely illustrated booklet, which explains the money-saving advantages of burning coal the modern, efficient way by the underfeed system on TAYLOR STOKERS. It is written for the executive, as well as the engineer.

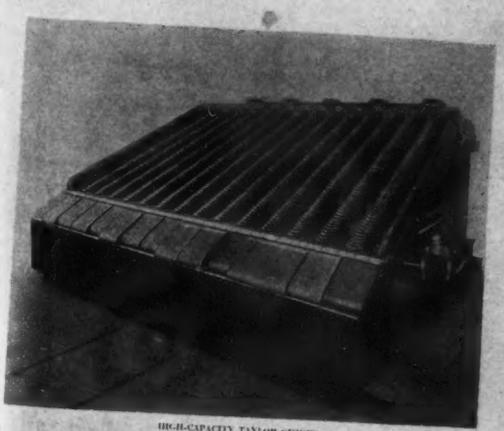
AMERICAN ENGINEERING CO.
Philadelphia, Pa.

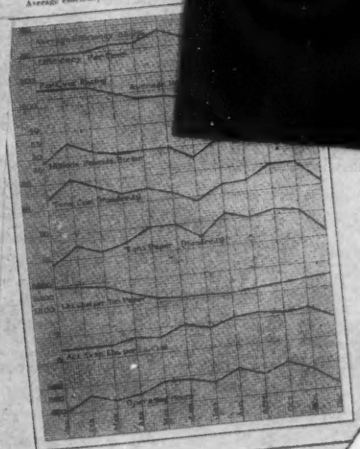
In Canada: Affiliated Engineering Companies, Ltd.
Head Office: Southam Bldg., Montreal








HIGH-CAPACITY TAYLOR STOKER



Please send me a copy of "Burning Coal the Modern Way."

Name.....

Company.....

Street.....

City.....

State.....

WE EXTEND the facilities of our organization to those desiring information or reports on companies with which we are identified.

Electric Bond and Share Company

Two Rector Street New York

WHEN governor problems arise our comprehensive experience will be of value to you. "Write for Catalogue M."

WOODWARD GOVERNOR CO., Rockford, Ill.

WOODWARD WATER WHEEL GOVERNORS

DETROIT ELECTRIC FURNACES
will
Build Power Business
for
THE CENTRAL STATION
Let us help increase your revenue
Detroit Electric Furnace Co.
825 W. Elizabeth St., DETROIT

HYDRAULIC TURBINES PENSTOCKS
BUTTERFLY VALVES GATES RACK RAKES
NEWPORT NEWS SHIPBUILDING AND DRY DOCK COMPANY
NEWPORT NEWS, VIRGINIA

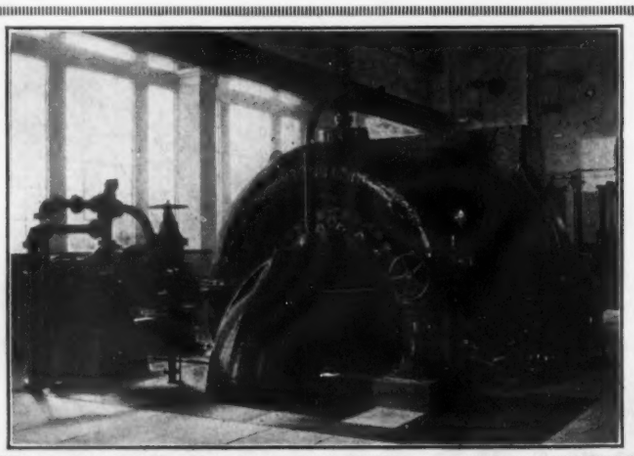
THE BABCOCK & WILCOX COMPANY
85 LIBERTY STREET, NEW YORK

ESTABLISHED 1868

Manufacturers of
Water-Tube Boilers, Steam Superheaters, Air Preheaters, Economizers, Chain Grate Stokers, Oil Burners and Refractories.
Pressure Vessels and Special Process Equipment.

BRANCH OFFICES

ATLANTA, Candler Building
BOSTON, 80 Federal Street
CHICAGO, Marquette Building
CINCINNATI, Traction Building
CLEVELAND, Guardian Building
DALLAS, TEXAS, Magnolia Building
DENVER, 444 Seventeenth Street
DETROIT, Ford Building
HOUSTON, TEXAS, Electric Building
LOS ANGELES, Central Building
NEW ORLEANS, 344 Camp Street
PHILADELPHIA, Packard Building
PHOENIX, ARIZ., Heard Building
PITTSBURGH, Koppers Building
PORTLAND, ORE., Failing Building
SALT LAKE CITY, Kearns Building
SAN FRANCISCO, Sheldon Building
SEATTLE, Smith Tower
HONOLULU, T. H., Castle & Cooke Building
HAVANA, CUBA, Calle de Aguiar 104
SAN JUAN, PORTO RICO, Recinto Sur 51



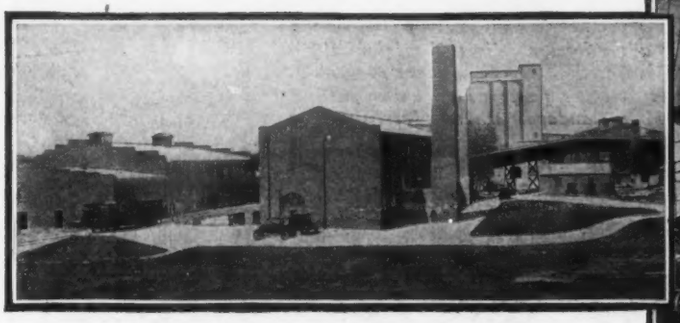
PELTON

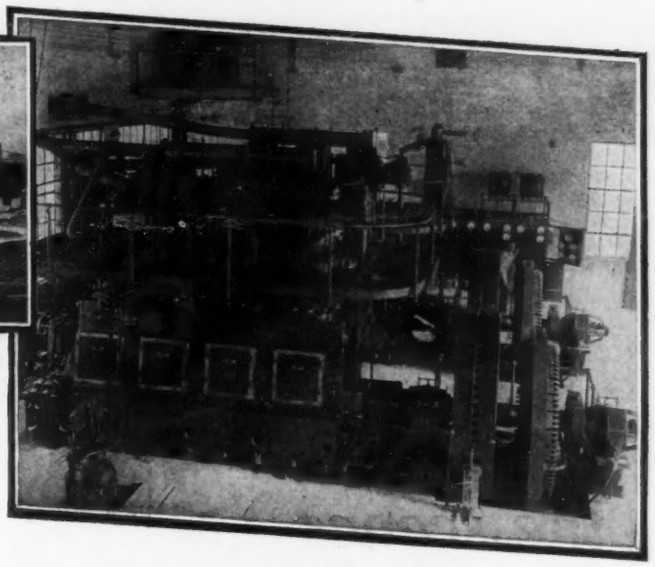
FULL AUTOMATIC HYDRAULIC CONTROL

The Pelton hydraulic controller is another outstanding contribution to lowered first costs as well as operating costs for hydro-electric plants. One of these units, shown at the extreme left in the adjacent picture, is installed in Spaulding No. 3 plant of the Pacific Gas & Electric Co., being operated by penstock pressure and remotely controlled by the forebay level. It is for use in block load plants and may likewise be controlled by tail water level. This plant is entirely automatic, the usual oil pressure governor being eliminated with appreciable reduction in capital investment.

THE PELTON WATER WHEEL COMPANY
Hydraulic Engineers
2983 Nineteenth St., San Francisco 33 Rector St., New York

PELTON





Dependable power at 1.32 ct. per kw-hr. in a small plant with low load factor

THE power plant of a Kansas Cement Mill (name on application) consists of two 338-b.hp. McIntosh & Seymour Diesel Engines, each driving a 230-kw. generator. The day load varies from about 160 to 170 kw., and a continuous load of something over 40 kw. is carried from 5:00 in the evening until 7:00 in the morning.

As will be noted, the power requirements are not only well within the capacity of one outfit, leaving the other as a spare and emergency unit and a provision for future plant growth, but most of the time the active set is under the unfavorable fractional load of hardly above 18 per cent. Figuring on one-unit operation, the load factor is less than 38 per cent.

The accompanying operating figures were handed to our representative during a recent service call. The actual cost per kilowatt-hour is really less than indicated, as the repair expense included was never spent, 400 gal. of the lubricating oil charged against the engines were used in other parts of the mill, and no value was assigned to the steam generated for heating the office building, from a small boiler served by waste engine heat.

10-Month Operating Record

Kw-hr. generated	536,255
Total engine hours	6,209
Fuel oil consumption	54,166 gal.
Average kw-hr. per gal.	9.9
Lubricating oil consumption	900 gal.

Operating Costs

Fuel oil, at 3 cts. per gal.	$1,624.98
Lubricating oil, at 50 cts. per gal.	405.00
Labor	4,050.00
Repairs, none, but reserved for same	840.00
Miscellaneous	150.00
	$7,069.98
Cost per kw-hr.	$0.0132

Taking all facts into consideration—small size of plant, low load factor, expense charged to but not incurred by the engines, and benefit not credited—this cost of 1.32 ct. per kw-hr. is ridiculously low in comparison with generating cost from any steam-electric plant of similar size. It is easy to understand why the owner is well pleased.

If you operate or expect to build a small or moderate size power, light or pumping plant, it would pay you to let our Engineers submit performance and cost data, based upon your own conditions. At least write for our literature.

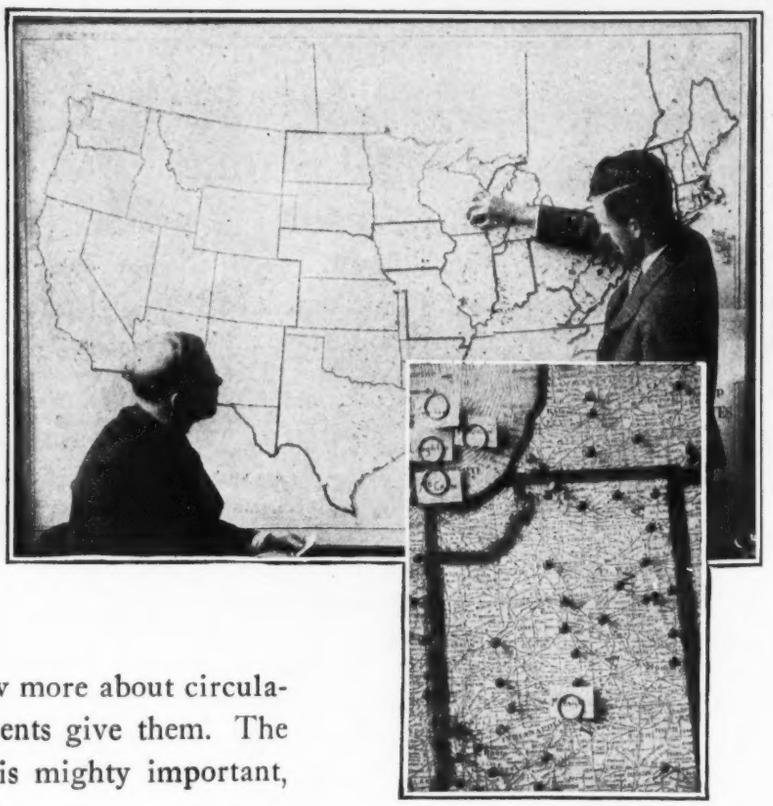
McINTOSH & SEYMOUR CORPORATION, Auburn, N. Y.

New York City, 149 Broadway — Kansas City, Mo., 1016 Baltimore Ave. — Jacksonville, Fla., 412 Bisbee Bldg. — San Francisco, Cal., 514 Matson Bldg. — Houston, Tex., 2703 Esperson Bldg.

McINTOSH & SEYMOUR DIESEL ENGINES

This is one of a series of McGraw-Hill advertisements directed originally to advertising men in an effort to make industrial advertising more profitable to buyer and seller. It is printed in these pages as an indication to readers that McGraw-Hill publishing standards mean advertising effectiveness as well as editorial virility.

Behind the scenes of circulation building



ADVERTISERS need to know more about circulation than circulation statements give them. The method of building circulation is mighty important, as the following questions suggest:

How do publishers locate and rate subscribing prospects? How do they get them? Why do they get them?

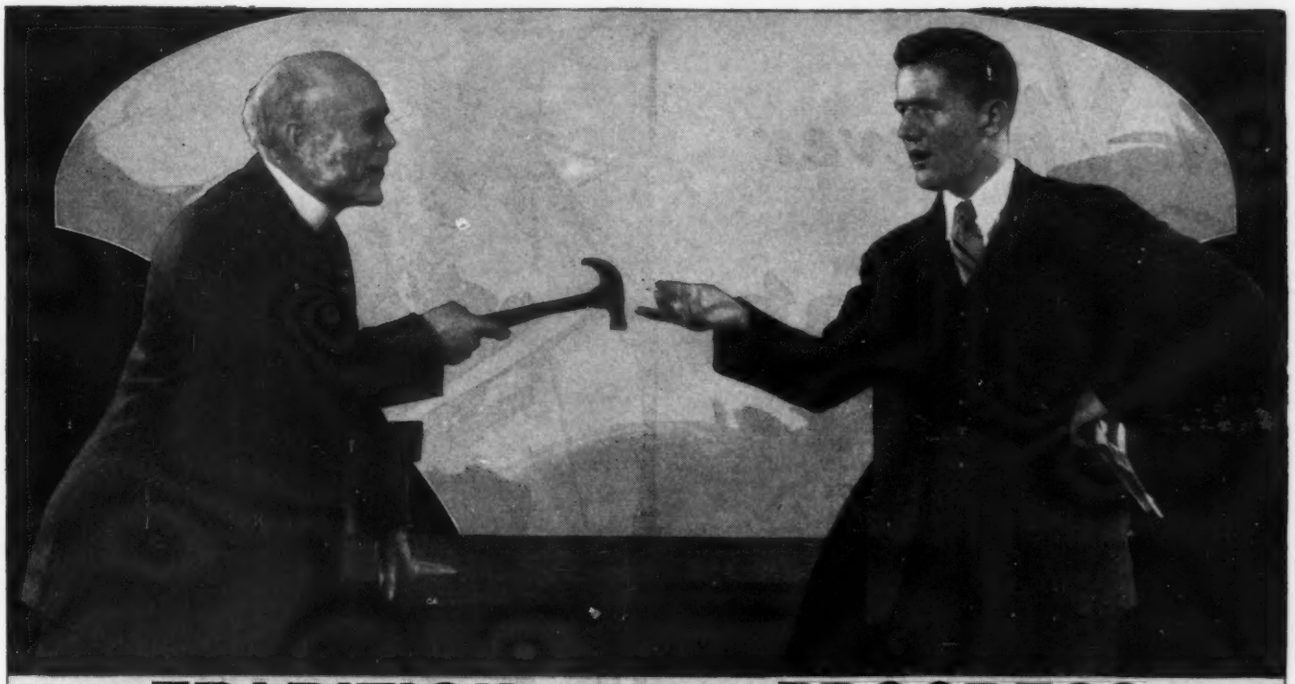
At McGraw-Hill circulation headquarters in New York there is a large map shown on this page. On it here and there are colored pegs which show what circulation we do not have—plants, utilities or service organizations whose buying power should be covered by a McGraw-Hill publication.

No one—publisher or manufacturer—can map his prospects in this way without continuous research.

Between 50 and 60 salaried McGraw-Hill circulation men participate in this research to locate, rate and get only the decision men of industry and business.

The McGraw-Hill circulation man is trained to help the reader subscribe to the publication that deals most intimately with his daily problems. That is why his card is open-sesame in important industrial plants throughout the country, whose policy is "no book agents admitted."

—The publishers



"Here, Lad—

I wish you would quit fighting for 'Linc-Weld' motors on our machines.

You've fought companies that must make very good motors.

Why don't you declare an *armistice* . . . we need to keep in these companies' good graces."

"Linc-Weld" Superiority is due to:

1. **Larger Shafts**
2. **Larger Bearings**
3. **Better Insulation**
4. **Stronger Frame (Steel)**
5. **Greater Overload Capacity**

"Yes, Pop—

You mean business graces.

We've already had FAITH in their prominence, HOPE for motor development, and CHARITY toward the limitations of cast motors.

But Lincoln has shown in the 'Linc-Weld' steel constructed motor with biggest shafts and bearings, that better performance and fewer shutdowns can actually be made available to users. Also that service of a lesser order costs us good money.

So I see no reason for an ARMISTICE — when it has been so well shown in world events that armistice is not so much a military word as a *financial* one."

The Lincoln Electric Co., Dept. No. 1-6, Cleveland, Ohio

"Linc-Weld"

M-45

LINCOLN MOTOR

Wherever Current Goes

Limitless, it seems, is public demand for the convenience and usefulness of electric powered appliances. Each year this demand seeks out new uses . . . creates new markets. It has strung wires to the remotest corners of the nation, and set some 20,000,000 small motors at work in homes and industries.

No appliance manufacturing decision, we believe, is more important than the selection of a source of motor supply . . . and none deserves more careful investigation. For motors *must not fail* if public confidence is to be maintained and appliance builders protected from ruinous service costs.

The Domestic Electric Company has devoted its entire business life to the development of *special* fractional horsepower motors, and to a study of problems of appliance design, manufacture and marketing. The fruits of this experience are available to appliance manufacturers through constant contact with principals of this organization, working as a department of the businesses we serve.

The growing number of widely varied fields in which Domestic motors are now in use is the best evidence of the unusual character of this service.

Domestic motors are now serving in these, and other, important appliance fields:

Sewing machines
Vacuum cleaners
Sanitation systems
Electric tools
Fruit juice extractors
Washing machines
Motion picture projectors
Hair dryers
Pipe threading equipment
Floor polishers
Saws
Sirens
Ventilating fans
Sanders
Wood working machinery
Automobile jacks
Oil flushers
Air compressors
Sprayers
Oil pumps
Dish washers
Meat choppers
Coffee mills
Ironers
Air clarifiers
Health machines
Drink dispensers
Cream separators
Can openers
Saw sharpeners
Saw tables
Electric hoists
Grinders
Cloth cutters
Oil burners
Sump pumps
Moving sign displays
Lawn mowers
Exhaust fans
Pipe cutters
Heaters
Blowers
Wire strippers
Garage door openers

We cordially invite anyone interested in the manufacture or sale of fractional horsepower motor appliances to inspect personally our factory and facilities.

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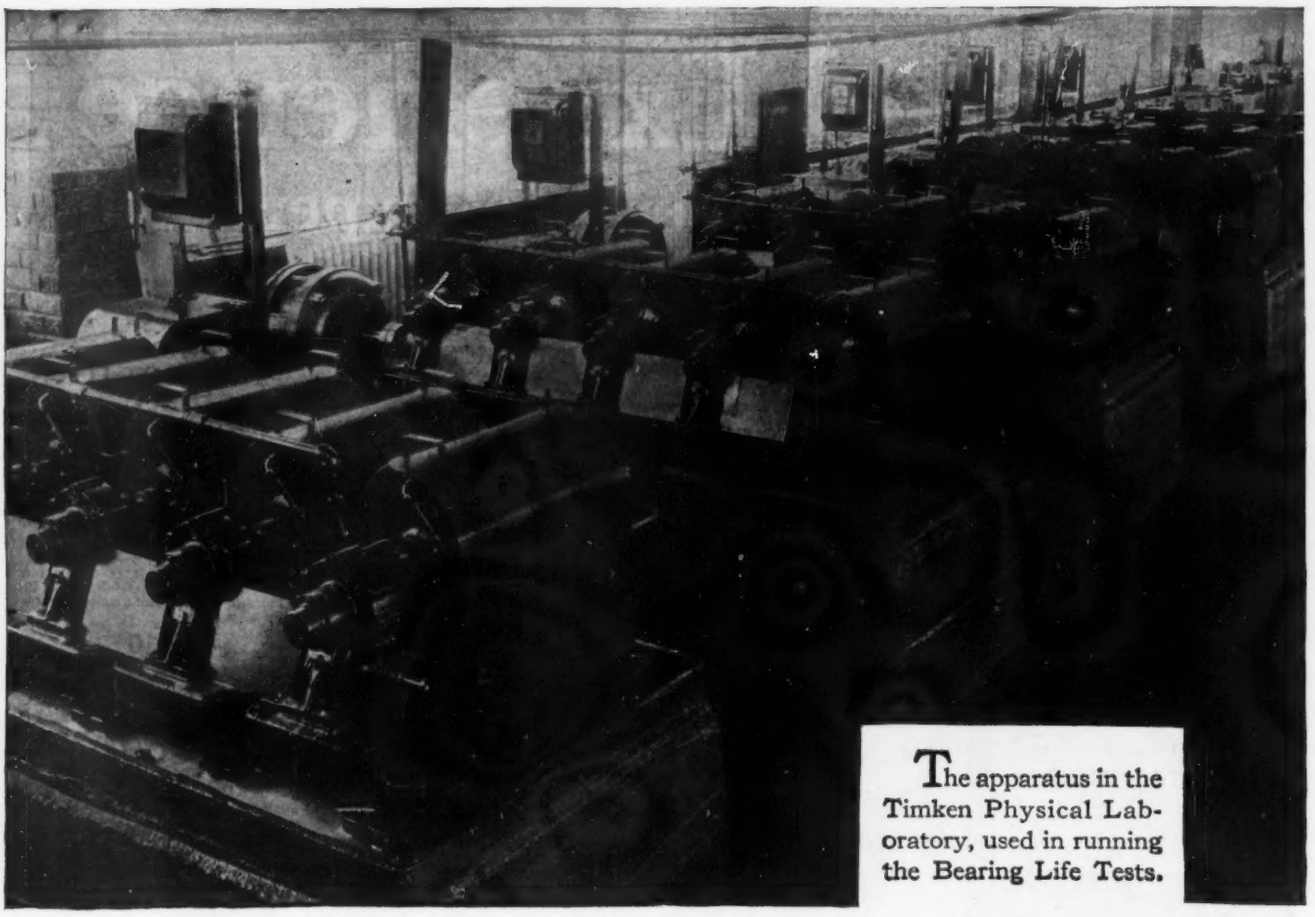

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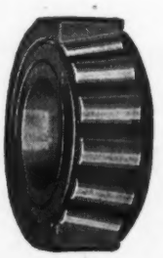

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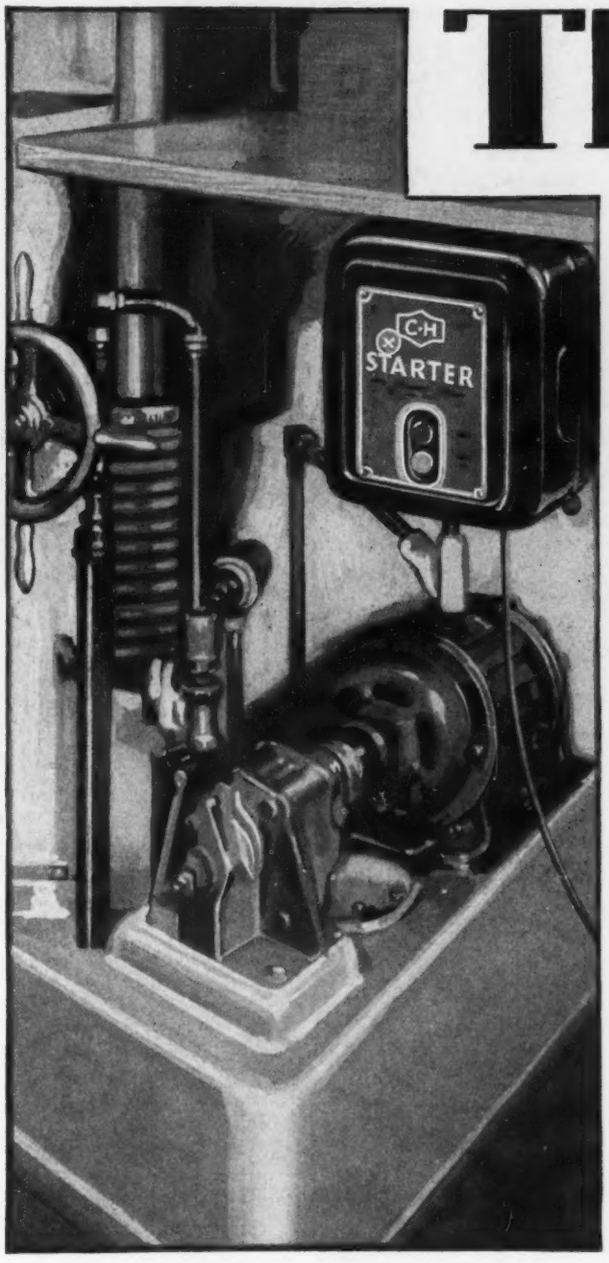

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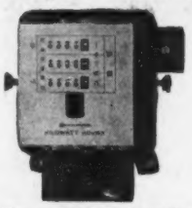

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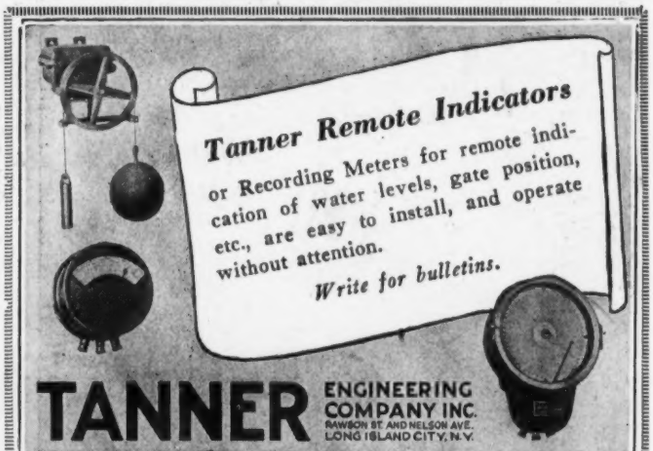
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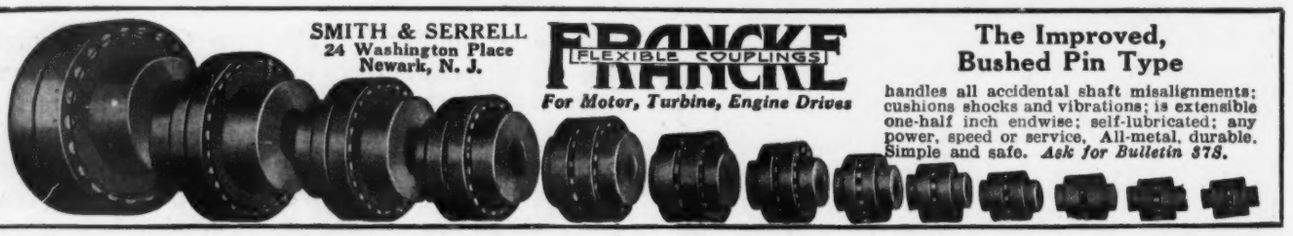

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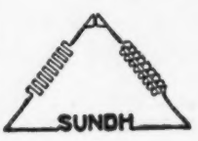

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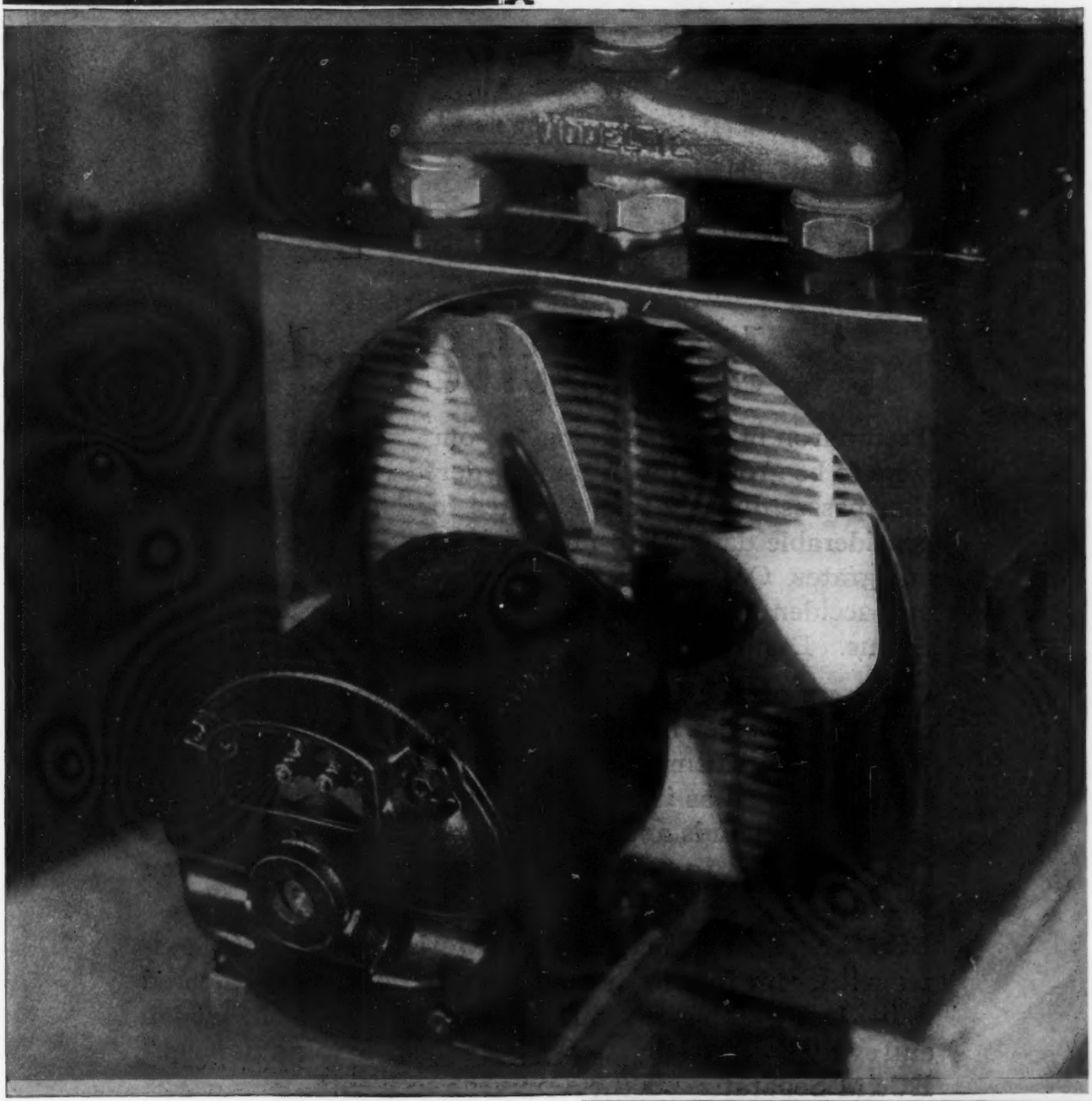

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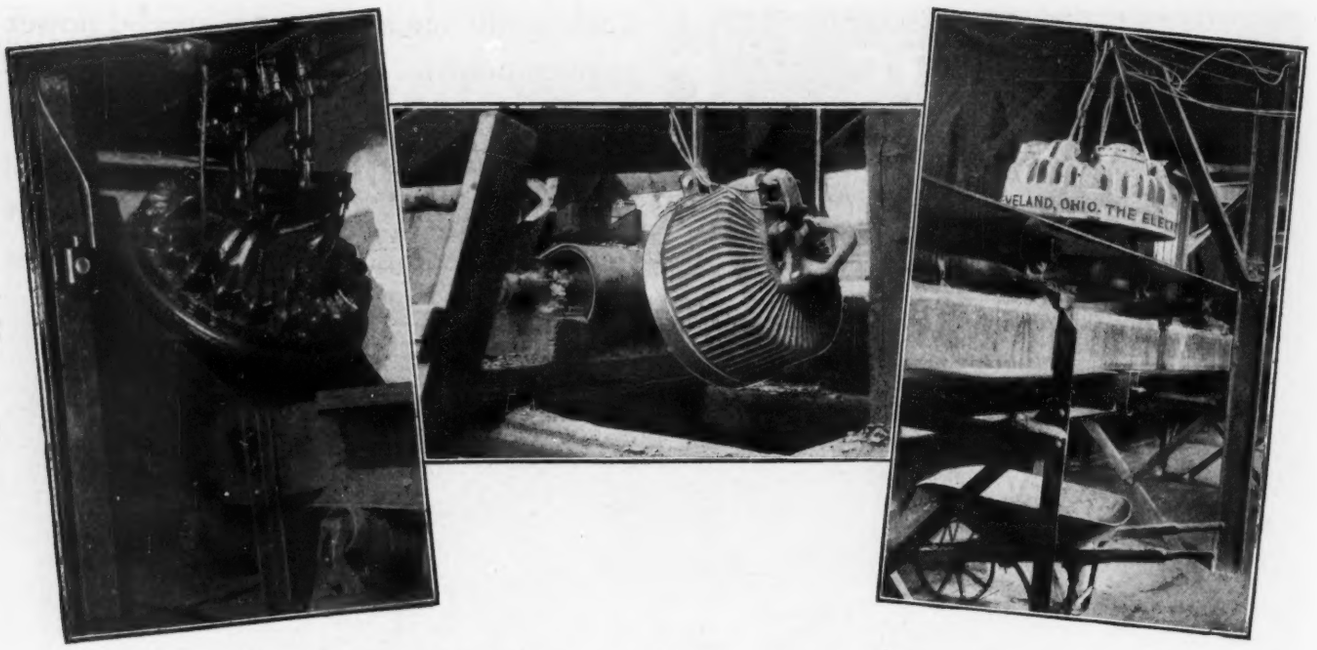

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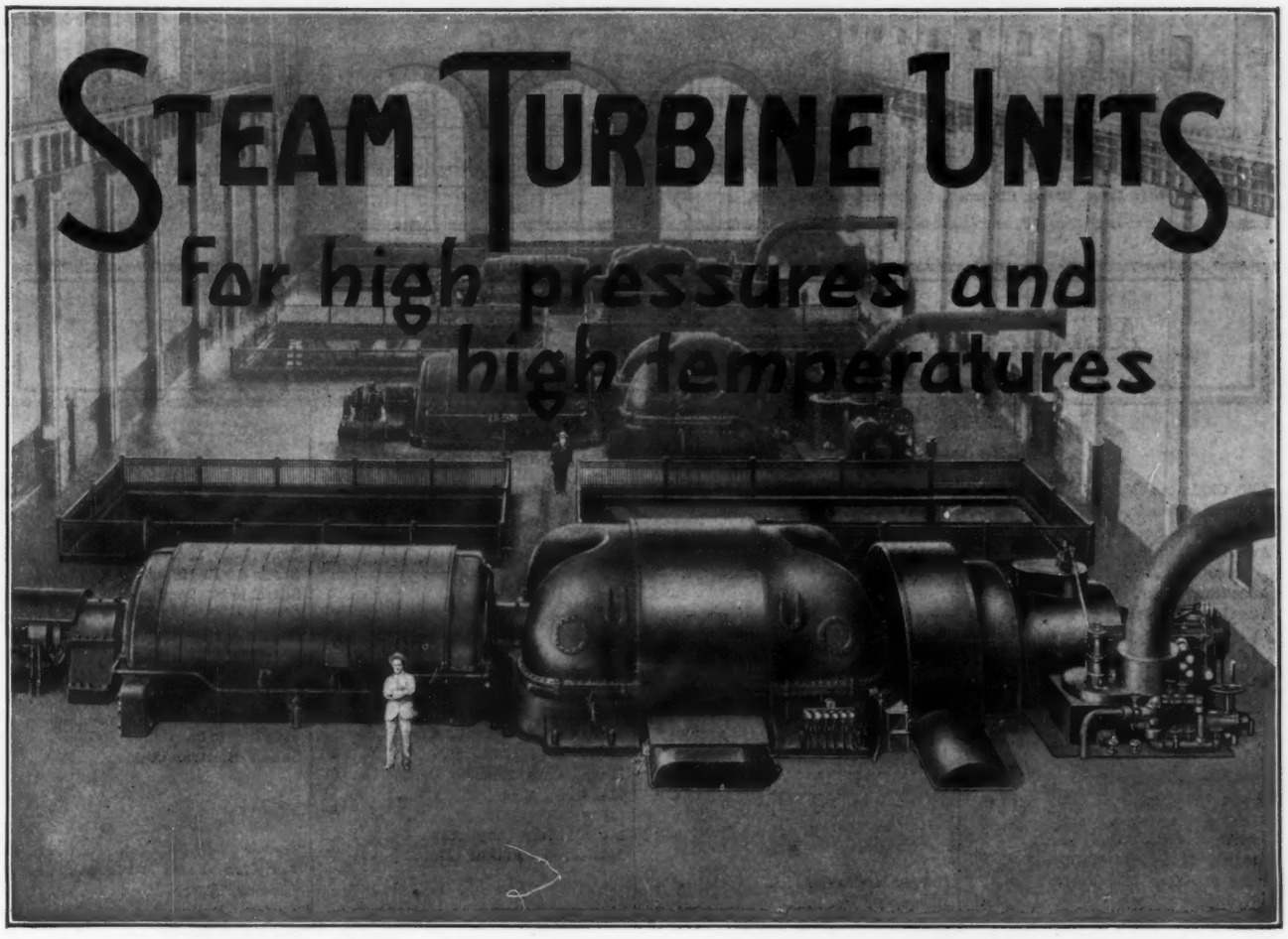

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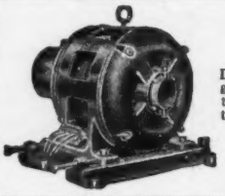

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G Type LL Circuit Breaker for generator protection — 1600 amperes at 250 volts D.C.—field discharge clips mechanically operated by breaker, clips close just before breaker opens and open as breaker closes — direct acting reverse current protection—solenoid or hand operation.

H Auto U-Re-Lite LL — 1600 amperes at 550 volts A. C. — 3 pole — two direct acting overload coils with time limit (Dalite) — non-closable against overload or short circuit (Autoite)—closed or opened manually with full safety to operators — rupturing capacity 40,000 amperes at 440 volts A. C.

I Type J Circuit Breaker — 10 amperes at 110 volts A.C. — single pole — direct acting under-voltage or no-voltage protection.

"Folks, you ain't seen nothin' yet! (Apologies to Mr. Jolson.) There's just the breaker you need in the I-T-E line—or we'll make it for you. What'll it be?"

★ ★ ★

I-T-E CIRCUIT BREAKER COMPANY
19th and HAMILTON STS., PHILADELPHIA

Birmingham, American-Traders Bank Building; **Boston**, 201 Devonshire; **Buffalo**, Ellicott Sq. Bldg.; **Chicago**, 333 N. Michigan Ave.; **Cincinnati**, Union Trust Bldg.; **Cleveland**, 439 Terminal Tower Bldg.; **Dallas**, 1810 Allen Bldg.; **Denver**, Tramway Bldg.; **Detroit**, Penobscot Bldg.; **Duluth**, 611 Providence Bldg.; **Kansas City**, Midland Bldg.; **Los Angeles**, 106 W. 3rd; **Minneapolis**, Plymouth Bldg.; **Montreal**, P. Q., 35 Notre Dame St. West; **New Orleans**, Hiberma Bank Bldg.; **New York**, 12 E. 41st St.; **Omaha**, Electric Bldg.; **Philadelphia**, 1505 Race St.; **Pittsburgh**, Park Bldg.; **St. Louis**, Bank of Commerce Bldg.; **San Francisco**, Russ Bldg.; **Seattle**, 802 33rd Ave.; **Toronto**, 149 Adelaide Street East; **Tulsa, Oklahoma**, 1165 N. Elwood Street; **Vancouver**, 500 Beatty Street.

Coming Attractions

J *I-T-E transfer switch* — 7500 amperes at 250 volts D. C. — full automatic switching from normal to emergency power source.

K *Auto U-Re-Lite Senior*—motor operated for remote starting of motors across-the-line — overload protection with time limit (Dalite) — 200 amperes at 550 volts D. C.

L *Type S circuit breaker* — 5 amperes at 110 volts D. C. — single pole—time limit (Dalite) overload protection.

M *Truck type* air circuit breaker switchboard — Cel-I-T-E construction — protecting circuits from 200 to 2500 amperes at 550 volts A. C.

N *I-T-E pneumatic type* electric railway circuit breaker — 4000 amperes at 600 volts D. C. — single pole—operated by compressed air.

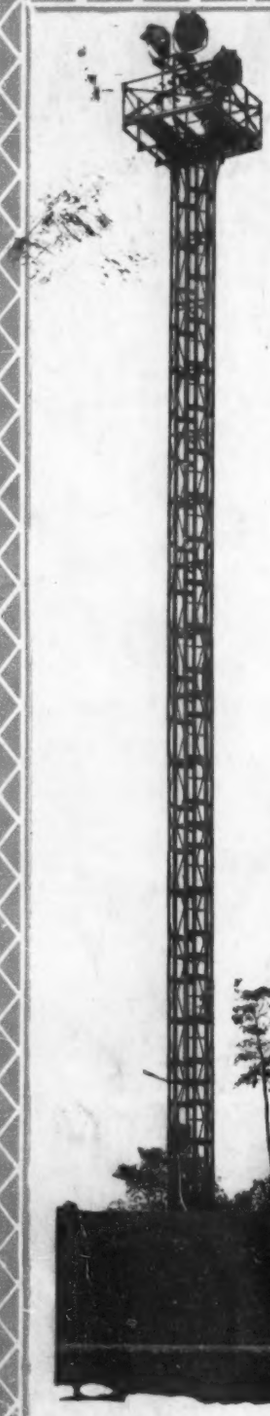
O *Type LX circuit breaker* — 600 amperes at 250 volts D. C. — single pole — direct acting overload protection with time limit (Dalite).

For complete information on dependable protection for any circuit up to 750 volts D.C. or 550 volts A.C. write or call our nearest office.

I-T-E PROTECTION

URELITES ~ ~ I-T-E CIRCUIT BREAKERS

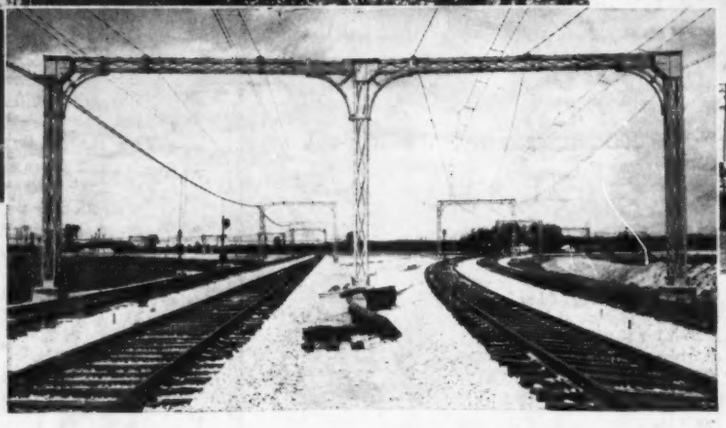
BATES-TRUSS POLES and STRUCTURES



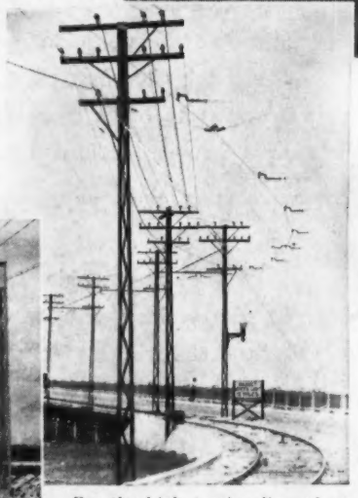
Public Utility Companies acknowledge the many superiorities of Bates-Truss wherever poles, towers or structures are used. This preference has led to the adoption of Bates-Truss products by Public Utility Companies throughout the country. The poles are expanded from one piece of metal—no rivets, bolts or welds. The Bates-Truss semi-fabricated towers and structures represent the most advanced engineering and manufacturing methods.

Specify "BATES-TRUSS"

Fabricated towers for nearly every type of tower service are handled complete in our own plant even to galvanizing. Get a Bates-Truss proposal on your tower installation.



Semi-fabricated structures combine Bates-Truss expanded one piece members with structural shapes utilizing the advantages of both. The semi-fabricated structures are adaptable to all types of service.



For the high tension line where structures are needed, recommend Bates-Truss. Quotations gladly furnished by our engineering department on all structures of this kind. Whatever your requirements, be sure to investigate Bates-Truss. Bates-Truss Poles for street and railway service have proved their superiority through years of service. Expanded from one piece, they offer the maximum in appearance, service and economy.

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